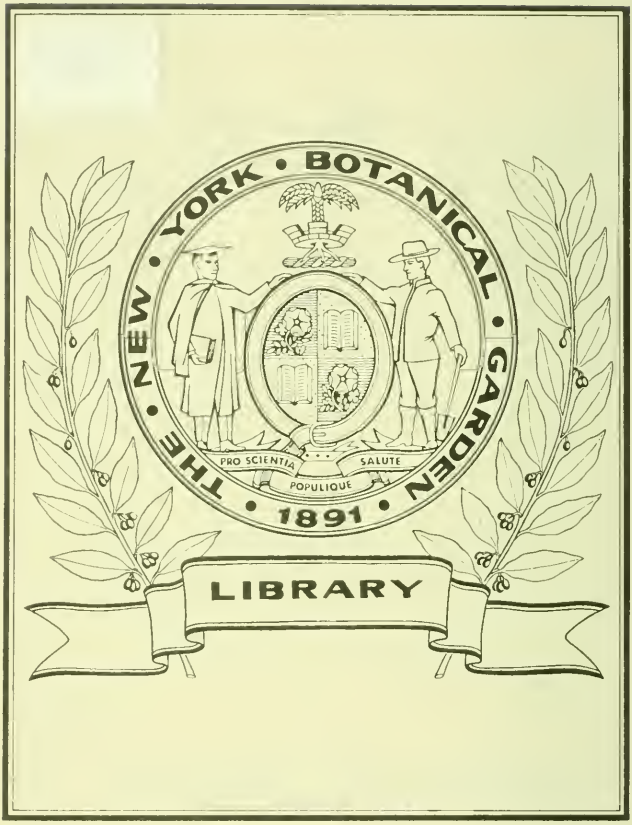
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Volume XXI February, 1921 Number 5

TECHNICAL PUBLICATION NO. 15

OF

The New York State College of Forestry

AT

SYRACUSE UNIVERSITY

TREES OF NEW YORK STATE NATIVE AND NATURALIZED

BY

H. P. BROWN, Ph. D.

Professor of Wood Technology

Published Quarterly by the University, Syracuse, N. Y.

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PREFACE

As an educational institution, the New York State College of Forestry is obligated to the people of the State of New York to give information regarding the forest resources of the state, chief among which are its trees. In the past we as a commonwealth have been profligate in the natural bounty with which nature has endowed us. We have watched with public serenity the wasteful exploitation of our forest resources with no thought of the future. Today we are faced with an appalling timber shortage within the state. Thousands of acres of forest lands lie idle which should be producing the forests of the morrow.

To exercise sane suffrage the public must be educated as to the natural resources of the state. We must know more of the kinds of trees which make up its forests, the game which inhabits them, the fish which live in the forest streams. Succeeding generations will criticize or commend us as we employ unwise or remedial measures. A wise forest policy presupposes two things, an extensive campaign of reforestation on idle forest lands within the state, and a close utilization of such forest resources, chiefly timber, as still remain. Closer utilization of wood requires a more specific knowledge of tree species and the information given in the following pages is an endeavor to meet this demand.

In writing this bulletin no contention is made that the field is a new one. The information given herein is included in the larger and more comprehensive "tree" manuals covering the trees of North America or, more specifically, those of the northeastern states. Unfortunately, however, many of the manuals are inaccessible to the general public because of the cost while others are of such a technical nature as to render their contents difficult of interpretation by the reading public. Moreover, such generalities often occur as to cause the reader some doubt as to what to apply to New York State. The present bulletin, covering the trees of the state only, omits much extraneous matter which would otherwise confuse.

In the publication of a tree bulletin the New York State College of Forestry is meeting a definite demand as evidenced by the numerous queries received relative to tree species within the

state. It is following a policy of public education already in force in neighboring states, many of which have tree bulletins. Trees play a large part in the economic and recreational life of the state and a better understanding and appreciation of them is bound to lead to ultimate good. In the treatment of the subject in hand it has seemed wise to include in these pages not only those trees which are conceded to be native to the state but also those which have become naturalized within our boundaries and propagate themselves in the wild condition. Listed among these are such foreign trees as the White Willow, the European Crack Willow, *Paulownia*, etc., or trees introduced from other parts of the United States, as Osage Orange and the Catalpas. Ornamental trees which are never found as "escapes" are omitted as are those species such as Witch Hazel or Cordate Willow which are shrubby within the state but arborescent elsewhere. In some cases the author has been in doubt as to just where to draw the line. The treatment throughout must be considered conservative.

There are within the borders of the state one hundred and thirty-three kinds of trees exclusive of *Crataegus*. Of these one hundred and nine may be considered as native and twenty-four as naturalized. Over two hundred species of *Crataegus* have been described for New York State alone but these exhibit such a multitude of bewildering forms as to be beyond the scope of the bulletin. The inclusion of *Crataegus* brings the total number of native arborescent species well over three hundred and ranks New York State as one of the richest in the Union in its arborescent flora. No attempt has been made to include the shrubby plants of the state in this publication.

The descriptions accompanying the plates are based in part on fresh and herbarium material available at the College of Forestry or in the herbarium of the Department of Botany, Syracuse University, in part from descriptions checked with living material from Sargent's Silva, Britton's North American Trees, Hough's Handbook of the Trees of the Northeastern States and Canada, Gray's Manual, and Bailey's Cyclopaedia of Horticulture. I am especially indebted to Prof. W. C. Coker of the University of North Carolina, to Prof. J. S. Illick, of the Pennsylvania State Forest Academy, to Mr. Henry Hicks of Westbury, Long Island, and to Mr. C. Leo Macy of Princeton, New Jersey, for assistance in collecting specimens of trees which grow along the southern border of the state.

The drawings were all made by Mr. J. Elton Lodewick, a graduate of the College of Forestry, to whom I am grateful for the zeal and loyalty which has made this work possible. Except in rare cases they were drawn directly from fresh material collected at Syracuse or sent to the college upon request and they were personally checked by the author as to accuracy upon completion.

Grateful acknowledgment is due my colleague, Dr. C. C. Forsaith, who has contributed the glossary giving the derivation of scientific names, and has likewise assisted me with many helpful suggestions.

. In conclusion I am happy to express my gratitude to all others who have in any way contributed to the publication. Not least among these is F. Franklin Moon, dean of the college, whose kindly interest in the project from the first materially helped to bring it to a successful conclusion. I have met always with a ready response from my students and friends in the collection of material and data covering the trees of the state and extend to them my sincere thanks.

H. P. BROWN.

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PLANTS VERSUS ANIMALS

Since this bulletin is concerned with trees and trees are plants, the proper use of it entails the right concepts as to what a plant is, its relation to other plants and animals, and to its environment. The following paragraphs are devoted to an elaboration of this phase of the subject. While the information thus imparted is treated in a general and cursory way and is likely to prove uninteresting, a proper conception and understanding of plants, and of their classification and general morphology is absolutely essential if one would glean the most from the descriptions which follow in the text.

People who are not conversant with plants and their life activities are prone to place them in a category entirely apart from animals. They do not think of them as living organisms which, like animals, must meet the vicissitudes of a varying, shall I say even hostile, environment, but more of the nature of inanimate objects, bound through the nature of things to one spot, capable of growth, 'tis true, but insensible to most of their surroundings. It may be conceded that the higher plants do lack motility. They do not respond instantly to aggression by teeth or claws or flight. Nevertheless the response is none the less sure, though less immediate. It may continue over days or months or years, but it is none the less certain. Plants differ from animals strikingly in being more plastic to their environment. Once the idea of plant dynamics is thoroughly ingrained the study of plants becomes not a toilsome journey in the identification of the inanimate, but rather a fascinating vista which beckons us onward to greater discoveries and a happier understanding of the power of the Infinite.

Life on this planet is absolutely dependent on the activities of green plants for it is in the green parts of plants that food in its elementary stages is manufactured from the elements.* There are plants which lack this green pigment, chlorophyll, but these exist either as parasites or saprophytes on organic matter previously elaborated. There are herbivorous and carnivorous animals. But these in turn are wholly dependent for their existence on the metabolic processes which go on in the green

* A few exceptions occur in the case of certain bacteria which build up compounds by chemo-synthesis.

portions of plants. The basis of all life, be it plant or animal, is that living substance known as protoplasm, and protoplasm requires carbon for its nutrition. In fact carbon is one of the essential constituent elements of that substance. But free carbon in any of the forms in which it occurs in nature cannot be directly assimilated by plants. Nor is the carbon dioxide which results from combustion absorbed directly in the processes of metabolism. It is first combined chemically in the plant tissues with hydrogen to form sugar or starch. Subsequently other organic compounds are elaborated from these by the protoplasm through a readjustment of molecules, and hence molecular weight, and by the addition of other elements such as nitrogen, sulphur, phosphorus, etc. The ultimate origin of all the organic compounds which are found in nature is in the green parts of plants. Plants possess the ability which animals lack of manufacturing complex organic compounds from carbon dioxide and water.

The gulf which separates the higher plants from the higher animals is obvious — so obvious in fact that one can never mistake the one for the other. The animal possesses motility; it has a highly developed nervous and circulatory system. Its tissues, aside from the bones, are soft and plastic. It is wholly dependent for its food on compounds elaborated by plants or, in the case of carnivores, in the bodies of other animals. The plant, on the other hand, is compelled to spend its whole life in one place. It lacks a nervous system and while there is a circulatory system this is less specialized, and utilized wholly in the movement of plant foods and water. Its tissues are firmer than those of the animal and differ in their chemical composition. The plant possesses leaves which contain the green pigment chlorophyll, thus permitting it to manufacture its own organic food.

But science tells us that the higher plants and animals have been derived from lower, less complex forms, the simplest of which are unicellular. Some of these simple plants are motile. Others, as the bacteria and fungi, are without the green pigment chlorophyll. The simple animals lack a nervous system worthy of the name and many engulf or swallow their food bodily. Others possess chlorophyll granules whose origin is still a matter of dispute. We are forced to the conclusion that there is no sharp dividing line between plants and animals. Differences which obviously separate the higher plants from the higher animals will no longer suffice. The simple forms of plants and animals intergrade.

TAXONOMY OF PLANTS

Taxonomy comes from the Greek νόμος and τάξις, meaning respectively law and arrangement, and is concerned with the logical arrangement of related things and the laws and principles governing that arrangement. Thus we may have the taxonomy of mollusks, insects, worms, and of fishes, in fact, of any group of organisms or of related things. The taxonomy of plants deals with the kinds of plants (identification), their nomenclature and classification.

NOMENCLATURE OF PLANTS

Plants have one or more so-called common names and a scientific name. The common names usually designate some peculiar feature or characteristic of the plant, the habitat where found, resemblance to some previously known form, or some use, often mythical, to which the plant may have been put. Willow Oak signifies the oak with willow-like leaves. Shining Willow designates the willow with shiny leaves. Swamp Poplar is found in swamps. Paper Mulberry refers to the mulberry, the bark of which is manufactured into paper. *Hamamelis virginiana* L. is known under the common name of Witch Hazel owing to the reputed value of its twigs in colonial times as divining rods to indicate deposits of precious metals and veins of water.

But common names at best are very confusing. Ironwood in New York may refer to *Ostrya virginiana* (Mill.) K. Koch, or *Carpinus caroliniana* Walt. In Australia it is applied to woods belonging to trees of such widely separated families as the *Leguminosae* and *Myrtaceae*. In Burma, *Xylia dolabriformis* Benth. goes under the name of Ironwood. The Ironwood of Ceylon and India is *Mesua ferrea* L. Added to the above is the confusion resulting from the use of different languages. The Maple is known as Ahorn in Germany, as Erable in France, as Arce or Meple in Spain. Scientific names are the same the world over. They are derived from the Latin or Greek and take Latin endings. Latin is a dead language and the rules which govern its syntax never change. *Pinus Strobus* L. will mean the same to a botanist now or a hundred years from now, be he Russian, German, Italian, or English.

A scientific name consists of three parts, a genus name

(plural-genera) which is always capitalized, a species name (plural-species) which is rarely capitalized, and the abbreviation of the name of the man who is given credit for its original description. The common Sugar Maple is *Acer saccharum* Marsh. while *Acer rubrum* L. signifies Red Maple. In general practice it is customary to omit the abbreviation of the author's name. The proper use of scientific names* may be well illustrated with the oaks. The various oaks all are assigned to the genus *Quercus;* in other words, they are different species of this genus. In the United States alone we have some eighty species which are designed by different scientific names as *Quercus rubra*, Red Oak; *Quercus coccinea*, Searlet Oak; *Quercus phellos*, Willow Oak, etc., each with the abbreviation of the author's name after the species name.

Generic and specific limits are more of a conception than a definite thing. Man aims at a natural classification, that is, one which indicates natural relationships, but the boundaries thus laid down may not be of those of nature. Plants which resemble each other as closely as the offspring of common parents are generally conceded to belong to the same species. A genus may contain but one species as in the case of *Ginkgo biloba* L., the Maidenhair Tree, or a hundred or more as in the case of *Salix* (Willow) where some one hundred and seventy species are recognized. The actual number of species assigned to a genus depends largely on whether the systematist is radical or conservative in his ideas. Unfortunately botanists often differ widely in their conception of plant relationships, especially as to specific limits.

In some cases the differences between plants are so slight as to render their separation into different species unjustifiable. It may be a difference in stature or in size and shape of the leaves or fruit which a different environment has occasioned. For example, the White or Canoe Birch of New York and southern Canada differs from the European White Birch in its greater size and larger leaves. In its other characters it approximates the European species very closely and conservative systematists con-

* For the derivation of the scientific and common names used in this text, the reader is referred to the glossary on page 375. They may be derived from any of the following sources: (a) An ancient common name (Latin, *Quercus*) or aboriginal name (Indian, *Powcohiccora–Hicoria*); (b) the name of the geographical locality (continent, *Prunus americana;* country, *Tsuga canadensis;* state, *Quercus marilandica;* city, *Picea sitchensis;* river, *Celtis mississippiensis*, etc.), from which the plant originally came; (c) habitat (Latin, *mons* — mountain and *colere* — to dwell, *Pinus monticola*); (d) the name of the discoverer or some person associated with the discovery, or in honor of some person (*Maclura* — Wm. Maclure, an early American geologist; (e) some peculiar feature of the plant (Latin, *nigra* — black, *Salix nigra*).

sider it but a variety of the European form and list it as *Betula alba*, var. *papyrifera* (Marsh.) Spach.

The selection of the scientific names of plants depends upon a complex system of rules based mainly on considerations of priority. Conservative botanists in this country are following a universal code of nomenclature according to a set of rules promulgated at the International Botanical Congress, held at Vienna, June, 1905.* The Vienna Code considers the first edition of Linnaeus' Species Plantarum of 1753 as the logical starting point for the nomenclature of the higher plants and adopts the generic names used by Linnaeus in his text. These were in part coined by Linnaeus himself and in part adopted by him and his followers from pre-Linnean authors. In the adoption of post-Linnean generic names, priority rules. The Vienna Code likewise adopts the earliest specific name used to designate a plant rather than that specific name which was first combined with the correct generic name. *Sassafras variifolium* (Salisb.) Ktze. indicates that Salisbury first applied the specific name of *variifolium* to Sassafras but used it with a different generic name. Kuntze was the first to use the specific name of *variifolium* correctly with the generic name, *Sassafras*.

CLASSIFICATION OF PLANTS

The ultimate aim of botanists and zoologists in the classification of plants and animals has been to devise a "natural system" of classification which would best indicate the natural affinities of related forms. Such a treatment is both logical and practical in that related forms are thus brought down together in congeries which permit of their identification and study with greater ease. Experience has taught that in the higher plants variation in the flower offers the best basis for a "natural" classification. Plants exhibiting likeness or parallelism in floral structure are found to share other characteristics in common which indicate clearly their common lineage. It is customary to consider those plants first which are conceded to have the simplest or most primitive flowers, thence to proceed to forms with greater specialization, considering those last which have the most complex flowers. The system is open to criticism in that it is sometimes difficult to determine whether a flower is inherently primitive in structure or simple by reduction.

In classification plants are first divided into large divisions

* There is also a Rochester and an American Code.

which have certain gross features in common, then successively into smaller divisions and ultimately into genera and species. The characters enumerated under successive divisions are increasingly specific and of narrower latitude. The divisions of such a classification are listed below, those in "italics" often being omitted. Clarity is rendered more certain by classifying the Paper or Canoe Birch according to this plan:

Kingdom	Vegetable.
Sub-kingdom	Spermatophytes.
Class	Angiosperms.
Sub-class	Dicotyledons.
Series	*Archichlamydeae.*
Sub-series	*Apetalae.*
Order	Fagales.
Sub-order	
Family	Betulaceae.
Tribe	
Genus	Betula.
Species	alba.
Variety	papyrifera.

The Vegetable Kingdom is divided into four sub-kingdoms, viz.:

Thallophytes	algae, fungi, bacteria, etc.
Bryophytes	liverworts and mosses.
Pteridophytes	ferns, scouring rushes, horsetails, club-mosses, and quillworts.
Spermatophytes	all seed plants, including conifers and deciduous trees.

A proper conception of the limits of these groups will lead to a better understanding of trees and the relation which they bear to other plants.

Thallophytes constitute the lowest division of the vegetable kingdom and include the simplest forms of plants: The plant body or thallus exhibits little variation or specialization in structure (though often a wide range of form) and usually carries on its life activities either in water or on a moist substratum. Included in this group are the *algae* (pond scums, seaweeds, etc.), and the *fungi* (Mushrooms, bracket fungi, etc.), both of which exhibit a remarkable variation in the form and size of the thallus but extreme simplicity in its structure. Many of the simplest Thallophytes are unicellular and some are free swimming and resemble minute animals. Sexuality has become well developed in may forms while in others it is totally lacking.

Bryophytes are best represented by the mosses although a

second group, the liverworts, is also included. The Bryophytes show a distinct advance in specialization over the Thallophytes. This is evinced through the definite establishment of a sexual stage in which the sexes may be distinguished, and an "alternation of generations" whereby a sexual stage or generation is followed by a semi-dependent, asexual stage which in turn again gives rise to sexual forms. While more specialized than Thallophytes, Bryophytes are, relatively speaking, simple plants. The plant body is an elementary structure which possesses chlorophyll and is in some cases thalloid, while in others it develops a primitive stem and leaves. True vascular tissue (vascular bundles) is entirely lacking.

Vascular plants make their appearance for the first time in the Pteridophytes, a group which includes the true ferns and what are recognized as fern allies, the horsetails, scouring rushes, club mosses, and quillworts. True roots, stems, and leaves equipped with special conducting or vascular tissue, have become established as definite structures and function as in the seed plants. As in the Bryophytes there is a sexual stage in which the sexes may be distinguished but the sexual organs have become increasingly specialized. This is followed by an asexual stage in which sexless individuals through spore formation again give rise to sexual forms. In the higher Pteridophytes it is the asexual or sporophytic stage that has become dominant while the sexual generation has been relegated to an obscure, independent existence or has become actually parasitic on the asexual generation. Pteridophytes were formerly represented by a vast assemblage of plants many of which were arborescent and flourished during the Carboniferous period, contributing largely in the formation of our coal deposits of today. Owing to an altered environment and the development of seed plants which are better adjusted to withstand modern conditions the group is now on the wane and is represented only by some 4000 species.

The dominant plants of today are the seed plants or Spermatophytes. They represent the highest type of specialization, though not necessarily the final type. Like the Pteridophytes they bear true roots, stems, and leaves and have an independent asexual or sporophytic stage on which the sexual or gametophytic stage is wholly dependent. The most striking difference lies in the formation of seeds which are dormant structures representing a pause in the development of the new sporophyte, designed by nature to tide the plant over unfavorable periods and to

insure a wider dissemination. Sexuality is a necessary part of the life cycle and is insured through the transfer of male elements to the proximity of the female nuclei by means of pollen grains. Following the union of the sex nuclei a young sporophyte or embryo is formed within the ovule or developing seed which, as the latter matures, passes into a dormant condition. Upon subsequent germination of the seed, the young sporophyte again assumes an active existence.

The Spermatophytes in turn are divided into two classes, the Gymnosperms and the Angiosperms, which are distinguished by the manner in which the seeds are borne. The word gymnosperm is derived from the Greek γυμνος, meaning naked, and σπερμα seed, and includes those Spermatophytes in which the seeds are not enclosed in an ovary but are borne naked, subtended by scales or fleshy structures. Angiosperm comes from the Greek ἀγγεῖον, meaning vessel, and σπερμα seed, and embraces those forms in which the seeds are borne enclosed in an ovary which may or may not dehisce at maturity. The boundary between the two groups is sufficiently clear to serve the purposes of classification although it in no way indicates the disparity in numbers and size.

Gymnosperms are very ancient and form but a small part of the present seed-plant vegetation. Some 450 living forms exist today which are to be regarded as the surviving remnant of a vast phyllum which had its genesis in the Carboniferous and flourished during the Triassic. Angiosperms were evolved comparatively recently (lower Cretaceous) in a geological sense and now are represented by a vast assemblage of approximately 125,000 species which comprise the bulk of the seed-plant vegetation of the present day. They have been able to attain and hold the ascendancy over the other groups because of adaptive features which they have developed to meet the environmental conditions in force at the present time. The chief superficial characters which separate the group from the Gymnosperms are the presence of the flower with its showy perianth, stamens and pistil and the manner in which the ovules or immature seeds are borne enclosed in an ovary.

Two sub-classes of Angiosperms are recognized, the Monocotyledons and the Dicotyledons, which are characterized as follows:

(a) Monocotyledons possess but one seed leaf or cotyledon which is terminal on the axis; dicotyledons possess two seed leaves which are lateral.

(b) The vascular bundles of monocotyledons are scattered in the stem; those of the dicotyledons are arranged in a ring, or the stem contains a vascular cylinder enclosing a pith.

(c) The leaves of the monocotyledons possess closed venation, that is, the veins do not end blindly in the margin which, as a result, is entire; dicotyledons possess leaves with open venation and the margin is often dissected.

(d) The flowers of the monocotyledons are chiefly 3-merous; those of the dicotyledons are predominately 4- or 5-merous.

Formerly monocotyledons were believed to be more primitive because of the greater simplicity of their floral structure. However, modern science has demonstrated that dicotyledons are of more ancient origin and that monocotyledons undoubtedly arose from them as an aberrant off-shoot in comparatively recent times.

The monocotyledons number some 25,000 species and are arranged in ten orders which are grouped in four series. The larger division, the dicotyledons, embraces thirty-four orders, some of which are represented wholly by herbaceous forms, while others consist wholly of woody plants or of both woody and herbaceous species. For convenience the first twenty-six orders of dicotyledons are sometimes listed as *Archichlamydeae* and include those forms which have either no petals (*Apetalae*), or petals entirely separate from one another (*Polypetalae*), a condition of the perianth (chlamys) which is conceded to be primitive. The remaining eight orders are characterized by a gamopetalous corolla and are included among the *Sympetalae.*

Gross flower characteristics usually distinguish the orders while minor floral characters are used to separate families and genera. An order may contain but one family or—as is generally the case in the large tropical orders—a number of families. Order names end in the Latin feminine plural "ales", as for example, the *Salicales*, *Fagales*, etc. This literally signifies "plant families related to the willow family," etc.

Family names end in *"aceae"*, which is the feminine plural of the Latin suffix *aceus*, meaning "like or related to". The family name is really an adjective agreeing with the understood name *"Plantae"*, as *Plantae Fagaceae, Plantae Oleaceae*, etc. Family names are commonly coined by prolonging the name of a genus of the group taken as a representative of it. For example, *Fagus* is a genus belonging to the *Fagaceae*, *Acer* to the *Aceraceae*, etc. Some family names have a different origin which

indicates the type of fruit prevailing, the manner in which the flowers are borne, or some other prominent feature of the plant. For example, the large tropical family, the *Leguminosae,* is so named because the fruit is a legume, while the flowers are always umbelliferous in the *Umbelliferae.*

The generic name of a plant is one word and substantive. Commonly it is the old classical name used by the Greeks and Romans as *Fagus* for Beech, *Acer* for Maple, *Corylus* for the Hazel, etc. Or it may be derived from some peculiarity of the plant as *Liriodendron* which comes from the Greek λείριον, meaning lily, and δένδρον, tree, referring to the lily-like flowers of this species. *Gymnocladus* means literally "naked branch" and refers to the stout, leafless branches in the winter condition. Other genera are dedicated to distinguished botanists or in honor of some person or of the discoverer of the plant. *Robinia* is named after John Robin, the first to cultivate this species in Europe; *Magnolia* is from the surname Magnol, in honor of Peter Magnol, a botanist of the 17th century. Generic names take the ending of the Latin nominative case.

The specific name is also a single word, appended to that of the genus. It is generally an adjective and agrees with the generic name in case, gender, etc. In general the generic names of trees are of feminine gender and require specific names with feminine ending, but exceptions to this rule occur, especially where the generic name was the ancient name of the plant. For example, *Acer* was the Latin name of the maple, is of neuter gender, and is followed by specific names with the endings of this gender.

Specific names* may denote (a) the locality (country, province, state, city, river, etc.), or habitat from which the plant originally came as *Ostrya virginiana*—from Virginia, *Salix babylonica*—from Babylonia, *Picea sitchensis*—from Sitka, Alaska; (b) some peculiar feature of the plant as *Salix purpurea*—referring to the purple branches, *Maclura pomifera*—referring to the large, pome-like fruits of the Osage Orange; (c) the name of the discoverer, or in honor of some botanist or person as *Quercus Michauxii*, for the surname Michaux, and referring to F. Michaux, one of the earlier dendrologists; (d) an ancient name, as *Pinus Strobus*, strobus being Latin and referring to a cone or something twisted. A substantive name when used specifically may not accord with the generic name in gender.

* See footnote, page 14.

For the derivation of scientific names used in the text, the reader is referred to the glossary on page 407.

Varietal names, where necessary, follow the same plan as specific names, and take the same endings. They are written thus: *Betula alba*, var. *papyrifera*.

CLASSIFICATION OF ARBORESCENT PLANTS

With the exception of a few tree ferns which are classed among the Pteridophytes and restricted to tropical habitats, arborescent plants are confined to the Spermatophytes and are represented by both Gymnosperms and Angiosperms. The dendroid Gymnosperms which are of economic importance as timber producers are restricted to the order *Coniferales* although *Gingko* and some of the Cycads become arborescent. Angiosperms include many monocotyledonous and dicotyledonous species which become trees and grow under manifold conditions and habitats. These are arranged, according to the usual scheme of classification, successively in orders and families. A somewhat arbitrary grouping of the orders into larger artificial divisions, for the sake of convenience, tends for greater clearness and renders the approach to the subject of Dendrology easier for the novice. Arborescent Pteridophytes and Monocotyledons are omitted as not being representative of temperate regions. The arborescent plants of the north temperate zone may be grouped roughly as follows:

(1) *Coniferae* (one order).
(2) *Amentiferae* (six orders).
(3) *Floriferae* (twenty-two orders).

Coniferae are characterized by (a) leaves which are usually evergreen, (b) seeds borne naked in cones or terminally without cone formation, (c) excurrent trunks, (d) wood without ducts or pores. Represented by forty genera and some 350 species, grouped under two families in the order *Coniferales*.

Amentiferae are characterized by (a) flowers inconspicuous, borne in aments, (b) fruit cupiliferous and generally a nut, (c) generally deliquescent trunks, (d) wood with ducts or pores. Represented by twenty-two genera grouped in six orders.

Floriferae are characterized by (a) typical flowers which are showy and not borne in aments, (b) fruit not cupiliferous and

in general not a nut. (c) generally deliquescent trunks. (d) wood with ducts or pores. Represented by many genera, widely scattered and interspersed with herbaceous forms through twenty-two orders.

The *Coniferae* are all woody, and are mainly inhabitants of temperate, alpine, or boreal regions. Many are important timber trees because of (1) the large stature, (2) excurrent trunks, (3) growth in pure stands, (4) inhabitants of temperate regions where industrial activity attains the greatest impetus. (5) even-grained, soft wood which takes nails and is readily worked with tools. See pages 76 to 105 inclusive.

The *Amentiferae* are preeminently plants of the temperate regions, are all woody, and include in their number such valuable timber trees as Oak, Chestnut, Beech, and Birch. See pages 106 to 199 inclusive.

The *Floriferae* is a heterogeneous group with great diversity of form, interspersed and intimately connected with herbaceous forms, and with many tropical affinities. Listed here are trees with showy flowers such as Black Locust, *Paulownia, Catalpa,* etc. See pages 200 to 343 inclusive.

IDENTIFICATION

The identification of plants may be made from drawings or pictures by turning directly to the illustrations. This is especially true where the plant is known to belong to a certain family or genus. The method is cumbersome and open to criticism in that it is unscientific and permits the student to acquire no grasp of the fundamentals underlying taxonomy.

The logical approach to the subject of plant identification lies in the use of previously prepared "keys" based upon morphological characters, which permit finally of the determination of species. Thus one may construct a key for the oaks, the maples, or the ashes, or, in fact, any group of related plants. It is customary for convenience to assemble keys for family, generic and specific identification into manuals which include all plants of certain groups represented in a given area. The most important manuals covering the higher plants of the northeastern states are, viz.:

Pteridophytes and Spermatophytes:

Gray, A. New Manual of Botany, 7th Ed., 1908.

Britton, N. L. Manual of the Flora of the Northern States and Canada, 2d Ed., 1905.

Trees:

Sargent, C. S. Manual of the Trees of North America, 1905.
Sargent, C. S. Manual of the Trees of North America, 2d Ed., 1922.
Britton, N. L. North American Trees, 1908.
Hough, R. B. Handbook of the Trees of the Northern States and Canada, 1907.

"Keys", as employed in manuals, are of the dichotomous type, that is, two or rarely more alternatives are presented for consideration, but one of which applies to the plant in question. These alternatives are co-ordinate in rank, are equally spaced from the left-hand margin, and deal with the same topic as illustrated by the simple key which follows:

1. Leaves simple	2	
1. Leaves compound	3	
2. Leaves palmately netted-veined		Maple.
2. Leaves pinnately netted-veined		Oak.
3. Leaves palmately compound	4	
3. Leaves pinnately compound	5	
4. Leaflets three		Poison Ivy.
4. Leaflets five		Virginia Creeper.
5. Leaflets three to seven		Shagbark Hickory.
5. Leaflets seven to nine		Bitter-nut Hickory.

Given: For identification, a plant included in the key, proceed as follows: Note whether the leaves are simple or compound. If simple turn to the alternatives listed under 2; if compound, to those listed under 3. Suppose, for the sake of illustration, we assume that the leaf is palmately compound and of three leaflets: From 1, you would proceed to 3, thence to 4, and finally to the specific determination of Poison Ivy.

It follows that the primary divisions of any key are less specific than the ultimate divisions. The greater the number of species included, the longer is the key. Eventually, by the process of elimination, the various species may be separated from each other.

DENDROLOGY

DENDROLOGY DEFINED

The taxonomy of woody plants as distinguished from herbaceous is called Dendrology. Dendrology means literally the "science of trees", but in general usage it has come to have a broader meaning and to comprise a taxonomic study of all woody plants.

Unfortunately the line delimiting herbaceous and woody plants is not a sharp one as the two types intergrade. Some plants are always woody; others are herbaceous or semi-woody, but on occasion may become woody. Tabulated below are the chief differences which distinguish woody plants, but it must be understood in advance that the information thus imparted must be used with reservation.

CRITERIA FOR DISTINGUISHING WOODY PLANTS

1. Woody plants are perennial, that is, they live from year to year. Annuals complete their life cycle within a season and are tided over the winter by their seed. Biennials may produce stems or canes, as in the raspberry, which are semi-woody the second year, but the two-year life span precludes their inclusion among typical woody plants.

2. Woody plants possess vascular tissue, that is, specialized conducting tissue. Not all vascular plants are woody by any means, as all the herbaceous flowering plants are numbered among the vascular plants. This prerequisite, however, excludes the Thallophytes and Bryophytes from the category of woody plants.

3. Woody plants possess an aerial axis or stem which persists from year to year. In the case of a tree this stem is called the bole or trunk. Many perennials fail to be classed as woody plants because they die back to the ground each autumn, the roots persisting through the winter and producing a new stem the following spring. Other plants, as many of the ferns, possess perennial, creeping stems and are woody plants in a strict sense, but not in the general sense as used in Dendrology.

4. Woody plants possess vascular tissue which becomes "lignified" or woody as it matures. This process of lignification is brought about by certain chemical and physical processes which take place in the woody part of the vascular tissue whereby its

cell walls are rendered harder, stronger and more durable than before. All woody tissues become more or less lignified the first year, soon after they attain their ultimate growth, and the process should not be confused with the changes which occur in passing from sapwood to heartwood. Lignification is in no sense confined to the so-called "woody plants", or, in fact, to vascular tissue. Woody stems possess in proportion more tissue that is lignified than herbaceous plants, and hence seem woody to us.

5. Typical woody plants possess secondary thickening, that is, have a means of thickening their stems by subsequent growth in diameter which is not traceable to terminal growing points. This is achieved through the activities of a growing layer or cambium which is situated just outside the last formed layer of wood and beneath the bark, and produces new wood and new bark yearly which are interpolated between the older wood and bark. This results in the formation of the annual rings which are characteristic of cross-sections of the trees of temperate regions. Tropical trees are often devoid of annual rings because cambial activity extends over practically the whole year and the resulting wood is quite homogeneous.

But there are arborescent ferns and monocotyledons (palms) which are devoid of secondary thickening of the normal type, in that the woody tissue is not gathered together in a cylinder surrounded by a cambium but is scattered through the stem in the form of isolated vascular bundles. In such arborescent forms subsequent seasonal increase in the thickness of the stem, where it occurs, is due to the continued enlargement, over a period of years, of tissues which had their inception in the apical growing point. This explains the fact that many palms support but a given number of leaves in their crown and new leaves develop only in proportion as some of the older leaves cease to function. In other cases, monocotyledonous stems increase in girth through anomalous secondary thickening, that is, not in the typical way. Finally there are many woody monocotyledons, especially lianas, which exhibit little or no secondary thickening, as in the case of *Smilax hispida* Mohl., the Hispid Greenbrier.

KINDS OF WOODY PLANTS

Woody plants are of three sorts, (1) trees, (2) shrubs, and (3) lianas, between which no hard and fast lines can be drawn. A given species may be shrubby near the limits of its range and

arborescent elsewhere. For example, Witch Hazel and Cordate Willow are shrubs in New York State but become trees farther south and west. Certain species of *Ficus* begin life as lianas but ultimately become arborescent. Again many woody plants which are reduced to dwarfed, scraggly shrubs in the boreal zone, attain to the dignity of large shrubs or even trees to the southward where they are not forced to contend with such a hostile environment. In general the kinds of woody plants may be defined as follows:

1. A tree is a woody plant which attains a height of at least twenty feet in a given locality and usually (not always) has but a single self-supporting stem or trunk.

2. A shrub is a woody plant which seldom exceeds twenty feet in height in a given locality and usually (not always) has a number of stems. Many shrubs have prostrate primary stems embedded in the soil or leaf-mold which send up persistent secondary branches of fruticose habit. These arise at varying intervals from the horizontal stem and appear as separate individuals.

3. A liana is a climbing woody vine. Lianas climb by twining, clambering, aerial roots, tendrils, etc., and are characteristic features of tropical rain forests. They are represented in our flora by such woody vines as Virginia Creeper, Clematis, Moonseed Vine, and the Wild Grape.

SPECIAL MORPHOLOGY

The use of a tree manual entails an understanding of the morphology of plant parts and of their proper interpretation. The primary basis of classification in trees, as in other seed plants, is the flower, for trees bear flowers as do other plants which produce seed. But the floral stage of trees is a fleeting one at best; floral characters are not available for study except for comparatively short periods. In a taxonomic study of woody plants, other specific characteristics such as leaf, twig, fruit and bark are generally stressed at the expense of floral characters. The following pages are devoted to Special Morphology in an endeavor to render more lucid that part of the text which follows:

LEAVES

General

The expanded green structures which make up the foliage of the higher plants, and in which physiological processes necessary to the life of the plant take place, are known as leaves. Foremost among such life activities are (1) photosynthesis or the synthesis of sugar from carbon dioxide and water, (2) transpiration or the voiding of excess water that has been taken up through root absorption, and (3) respiration or breathing.

A foliage leaf always possesses an expanded part or lamina which is specially adapted by internal structure and the presence of breathing pores or stomata to perform the functions assigned to it by nature. In addition there may be a stalk or petiole which attaches the lamina to the stem, and stipules, inserted separately on the stem at the base of and on either side of the petiole (Fig. 1). A leaf which is devoid of petiole is said to be epetiolate

FIG. 1— PORTION OF A TWIG WITH LEAF ATTACHED, SHOWING LEAF PARTS

or sessile; a leaf without stipules is estipulate. Stipules, where present, are in the majority of cases apparently vestigial structures and have no real function. In other cases they are modified into thorns (as in the Black Locust) or act as bud scales which protect the growing points during the winter (Basswood).

Leaf Variation

Of the primary plant parts, namely root, stem, and leaves, the latter are by far the most plastic and respond most quickly to an altered environment or habitat. Such external stimuli manifest themselves in leaves of various shapes and sizes and result not only in wide differences between the leaves of different

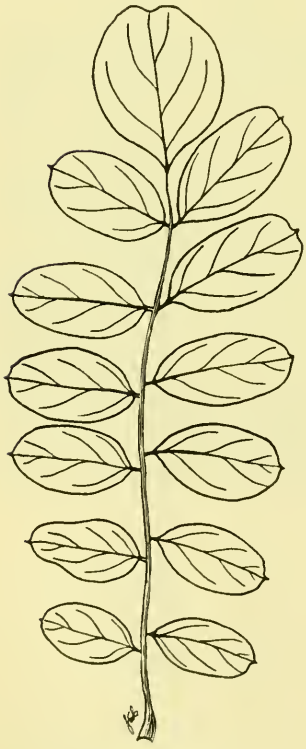


FIG. 2 — ODD PINNATELY COMPOUND LEAF

FIG. 3 — EVEN PINNATELY DECOMPOUND LEAF

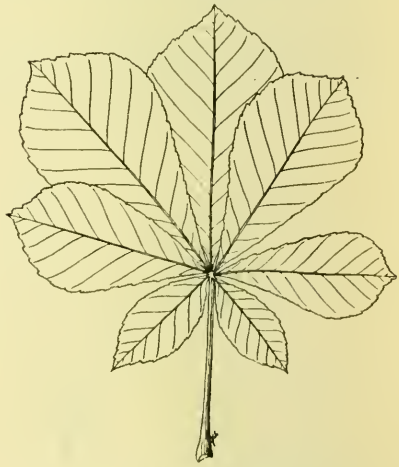


FIG. 4 — PALMATELY COMPOUND LEAF

species, but even within one and the same species and on the same plant. Variation in the size, shape, margin, etc., of foliage leaves is of the utmost importance in tree identification.

Leaf Classification

A. Leaves classified as to Position (Phyllotaxy)

1. Alternate — one inserted at a node.
2. Opposite — two at a node, inserted on opposite sides of the stem.
3. Verticillate or whorled — three or more at a node.

Alternate leaves are arranged in ascending left to right spirals on the stem and according to a definite plan. The portion of the spiral from one leaf to one directly above it is termed a cycle. Spiral phyllotaxies are represented by the fractions ½, ⅓, ⅜, etc., in which the numerator represents the number of turns and the denominator the number of leaves in a given cycle.

B. Leaves Classified as to Composition

1. Simple, with undivided lamina. (Fig. 1.)
2. Compound, lamina divided into leaflets.
   a. Pinnately compound, leaflets arranged along the two sides of the rachis.
      (1) Odd pinnately compound, with an odd number of leaflets.* (Fig. 2.)
      (2) Even pinnately compound, with an even number of leaflets.
      (3) Pinnately decompound, twice pinnately compound. (Fig. 3.)
   b. Palmately compound, leaflets radiating from the ends of the petiole. (Fig. 4.)
      (1) Ternately decompound, palmately decompound in threes.

C. Leaves Classified as to Form

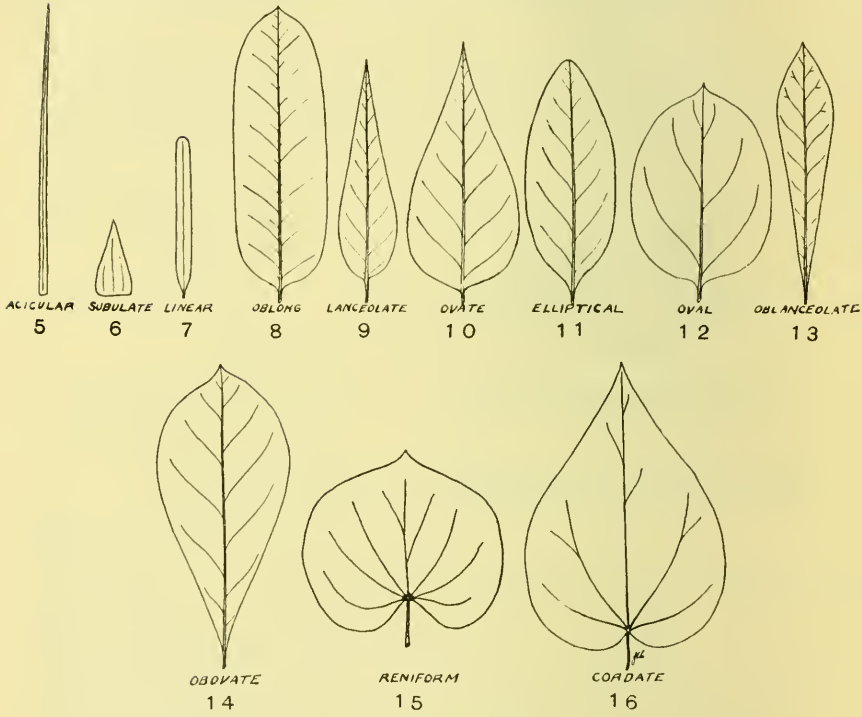
1. Acicular, long and very slender; needle-like. (Fig. 5.)
2. Subulate, awl-shaped; short, sharp-pointed, broadened at the base. (Fig. 6.)
3. Linear, narrow, several times longer than wide, and with sides approximately parallel. (Fig. 7.)
4. Oblong, longer than broad, and with approximately parallel sides. (Fig. 8.)

* Leaflets may be borne opposite or alternate on the rachis in (1) and (2).

Leaf Classification — Continued

C. Leaves Classified as to Form — Continued

5. Lanceolate, several times longer than broad, broadest about one-third up from the base, and narrowed to an attenuate apex. (Fig. 9.)
6. Ovate, shaped like a hen's egg with the broadest part down. (Fig. 10.)
7. Elliptical, shaped like an ellipse. (Fig. 11.)



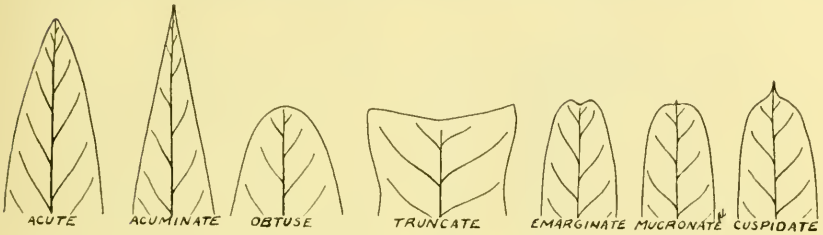
Leaf Shapes

8. Oval, broadly elliptical, with the short diameter more than half the long diameter. (Fig. 12.)
9. Orbicular, circular.
10. Oblanceolate, inversely lanceolate (Fig. 13); obovate (Fig. 14), inversely ovate, etc.
11. Spatulate, shaped like a spatula; rounded above and narrowed below like a spatula.
13. Reniform, kidney-shaped. (Fig. 15.)
12. Cordate, heart-shaped, with the point upward. (Fig. 16.)

Leaf Classification — Continued

D. Leaves Classified as to Apex

1. Acute, shaped like an acute angle but not attenuated. (Fig. 17.)
2. Acuminate, shaped like an acute angle and attenuated. (Fig. 18.)
3. Obtuse, blunt or rounded at the end. (Fig. 19.)

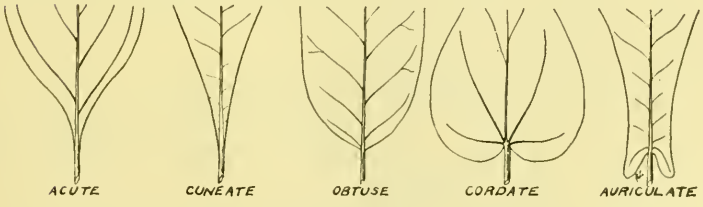


Leaf Apexes

4. Truncate, abruptly terminated as though cut off transversely. (Fig. 20.)
5. Emarginate, with a shallow notch. (Fig. 21.)
6. Obcordate, heart-shaped at the apex.
7. Mucronate, tipped with a mucro; abruptly tipped with a point. (Fig. 22.)
8. Cuspidate, tipped with a sharp, rigid point. (Fig. 23.)

E. Leaves Classified as to Base

1. Acute, shaped like an acute angle, but not attenuated. (Fig. 24.)
2. Cuneate, shaped like a wedge; broad above and tapering evenly to an acute base. (Fig. 25.)
3. Obtuse, blunt or rounded. (Fig. 26.)
4. Cordate, rounded and with broad rounded sinus. (Fig. 27.)



Leaf Bases

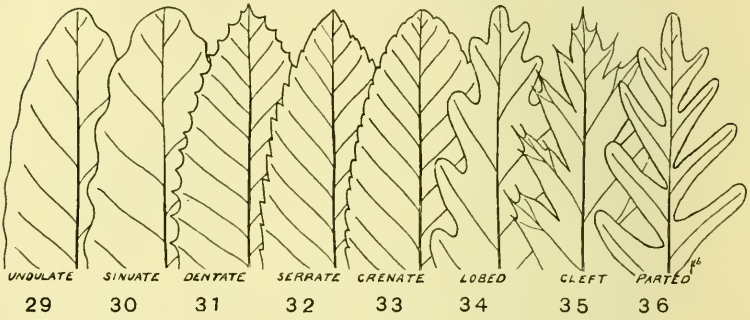
Leaf Classification — Continued

E. Leaves Classified as to Base — Concluded

5. Auriculate, with ear-like appendages at the base. (Fig. 28.)

F. Leaves Classified as to Margin

1. Entire, said of a margin without teeth or indentation.
2. Undulate (or repand), shallowly wavy. (Fig. 29.)



Leaf Margins

3. Sinuate, strongly wavy. (Fig. 30.)
4. Dentate, toothed, generally with the teeth projected outward. (Fig. 31.)
5. Serrate, with sharp teeth projecting forward. (Fig. 32.)
6. Crenate, dentate or serrate with rounded teeth. (Fig. 33.)
7. Lobed, divided into lobes by sinuses which extend not more than half way to the midrib, either the sinuses or lobes rounded. (Fig. 34.)
8. Cleft, divided into lobes by sinuses which extend half way or more to the midrib, either the sinuses or lobes, narrow or acute. (Fig. 35.)
9. Parted, divided by sinuses which extend nearly to the midrib. (Fig. 36.)

G. Leaves Classified as to Venation

1. As to the arrangement of veins.
   a. Pinnately veined, veins branching laterally from a strong longitudinal median vein, the midrib. (Fig. 38.)
   b. Palmately veined, primary veins radiating from the apex of the petiole. (Fig. 37.)

Leaf Classification — Continued

G. Leaves Classified as to Venation — Continued

2. As to direction of veins with reference to each other.

a. Netted, anastomosing to form a network or reticulum.

b. Parallel, parallel and without apparent reticulum.

Palmate and Pinnate Venations

INFLORESCENCES

The flowering part of a plant, especially the disposition of flowers on a plant, is known as the inflorescence. Inflorescences have received distinctive names which indicate the various sorts, but all are reducible to two main types, the indeterminate and the determinate, which occasionally intergrade to form a mixed inflorescence. Inflorescences may be classified as follows:

I. Indeterminate inflorescence. Axis of inflorescence terminated by a growing point which may prolong the floral axis indefinitely. Flowers from axillary buds.

a. Solitary. Said of flowers when they appear solitary in the axils of normal foliage leaves.

b. Clustered. Said of flowers when they are aggregated in groups. Foliage leaves are reduced to bracts or disappear altogether.

1. Simple clusters. Secondary axis terminated by a flower.

(a) Spike. Flowers all sessile along the main axis. (Fig. 39.)

(b) Catkin or ament. A flexuous, scaly spike. (Fig. 40).

Inflorescences — Continued
Indeterminate inflorescences — Continued
Simple clusters — Continued

(c) Raceme. Flowers all on pedicels which are shorter than the main axis. (Fig. 42.)

(d) Umbel. Flowers all on nearly equal pedicels which spring from a common point like the ribs of an umbrella. (Fig. 44.)

(e) Head. Flowers all sessile or nearly sessile and aggregated into a dense cluster on a receptacle or short axis. (Fig. 41.)

2. Compound Clusters. Secondary axis bearing several flowers arranged according to a definite plan.

(a) Compound spike. Twice spikately compound.

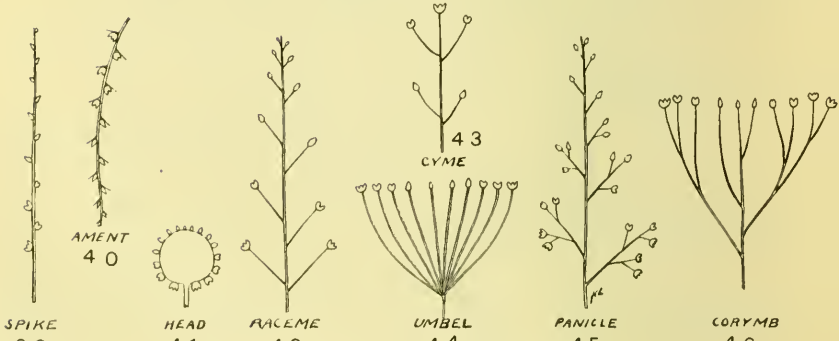
(b) Compound raceme. Twice racemosely compound.

(c) Compound umbel. Twice umbellately compound.

3. Irregular clusters.

(a) Panicle. A racemose flower cluster in which some of the secondary clusters bear several irregularly disposed pedicelled flowers. (Fig. 45.)

(b) Corymb. A flat-topped flower cluster of the racemose type, with pedicels arising at different points along the main axis. (Fig. 46.)



Types of Inflorescence

II. Determinate inflorescence. Axis of inflorescence terminated by a flower which prevents further elongation of the primary axis. Represented by but one type with various modifications, the cyme. (Fig. 43.)

III. Mixed inflorescence. Said of an inflorescence in which both indeterminate and determinate types of branching are found; primary branching of one type, secondary branching of another type; rare in trees.

FLOWERS

General

Flowers are structures characteristic of the Spermatophytes or seed plants and bear stamens and ovules or immature seeds. In Gymnosperms these ovules are not enclosed in an ovary but are borne naked or in the axils of cone scales, and the flowers are devoid of perianth, while in the Angiosperms an ovary is always present and is usually accompanied by a more or less showy perianth. The function of flowers is that of seed production and the various floral parts, included under the terms perianth and essential organs, are to be considered as modified leaves. The parts of a typical flower are as follows (see Fig. 47):

Floral Parts

I. Pedicel or peduncle. Stalk of flower.

II. Receptacle. End of peduncle bearing the remaining parts, usually somewhat enlarged.

III. Perianth. The outer sets of modified leaves composing the non-essential part of the flower.

a. Calyx. The outer set, consisting of sepals, usually green in color.

b. Corolla. The inner set, consisting of petals, usually showy in color.

IV. Essential organs. Stamens and pistil.

a. Androecium. The outer set of essential organs, the stamens, each consisting of an anther or pollen-bearing portion, borne on a stalk or filament.

b. Gynoecium. The inner set of essential organs, the carpels, which unite to form a pistil. A pistil consists of (1) an enlarged basal part bearing ovules, (2) a slender stalk above, the style,* and (3) a terminal portion, receptive to pollen, the stigma.

* Style may or may not be present.

Pollination versus fertilization

The higher plants, like the higher animals, exhibit sexuality which insures the continuance of a vigorous race. Early systematists believed the stamens and pistils of flowers to be male and female organs, but modern science has dissipated this belief. Stamens and ovules are rather the "bearers of sexual elements." The pollen grains which are loosed in immense numbers from the anther sacs of the stamens bear nuclei which have within them the inherent feature of the male strain, while in the interior of the ovule, other nuclei are borne which are female nuclei. The transfer of pollen from the stamens to the vicinity of the ovules (stigma of angiosperms) is known as pollination and is brought about by various agents such as wind, insects, birds, and water. Subsequently the pollen grains germinate and form a tube which eventually permits of the union of the sex nuclei. Between pollination and fertilization only a few hours may intervene while in other cases it may be months before fertilization is assured.

Cross pollination, that is, the transference of pollen from one flower to the vicinity of the ovules of another, is desirable, and nature has devised many floral modifications to bring this about. Many plants exhibit diclinism, that is, imperfect flowers which may be monoecious, dioecious, or polygamous, and rely on wind or insects for pollination. Wind pollinated plants are usually characterized by abundant pollen which is often shed in advance of the leaves, inconspicuous flowers, expanded or feathery stigmas, or explosive mechanisms in the stamens which catapult the pollen. Flowers which are insect pollinated are usually bright colored or possess nectarglands which excrete saccharine or mal-odorous substances attractive to insects.

Other plants, (some of the maples) exhibit dichogamy and dimorphism as a device to insure cross pollination. In dichogamous forms the stamens of a flower reach maturity in advance of the pistil (proterandrous) or vice versa (proterogynous) and this insures the union of sexual nuclei from different flowers. Dimorphic flowers are insect pollinated and have the essential organs arranged differently and in such a manner that an insect on visiting the one flower is dusted with pollen which is rubbed off by the stigma of the next.

Variation in the flower.

In addition to the floral modifications which have been obviously devised to insure cross pollination, flowers exhibit a truly wonderful variation in form, size, and in the arrangement, sup-

pression, or union of parts that is quite beyond belief. Botanists observed this long ago and have learned from experience that the variation in the flower best indicates the natural affinities of flowering plants. Plants with comparable floral structures are related to each other. Flowers may be classified according to these variations as follows:

A. Suppression and symmetry of parts.
  a. Perfect. With stamens and pistils (essential organs) present.
  b. Imperfect. With stamens or pistils or both in separate flowers.
    1. Monoecious. With the staminate and pistillate flowers on the same plant.
    2. Dioecious. With the staminate and pistillate flowers on separate plants.
    3. Polygamous. With the perfect and imperfect flowers on the same plant.
      (a) Polygamo-monoecious. With the perfect and both sorts of imperfect flowers on the same plant.
      (b) Polygamo-dioecious. With perfect and staminate flowers on one plant and perfect and pistillate on another.
  c. Complete. With all four sets of floral organs present.
  d. Incomplete. With one or more sets of floral organs lacking.
  e. Regular. With the individuals of each set similar in form and size.
  f. Irregular. With the individuals of some sets varying in form or size from the others.

B. Position of parts.
  a. With reference to insertion on the receptacle.
    1. Spiral. With floral organs spirally arranged.
    2. Cyclic. With the parts of each set all inserted on the receptacle at the same height.
  b. With reference to each other.
    1. Flower hypogynous. With the three outer (lower) sets inserted below the ovary.
      (a) Strictly hypogynous. With the three outer (lower) sets inserted separately below the ovary. (Fig. 47.)

Variation in the flower — Continued

B. Position of parts — Continued

Flower hypogynous — Continued

(b) Epipetalous hypogynous. With the stamens inserted on the corolla, otherwise as above. (Fig. 48.)

2. Flower perigynous. With the calyx inserted below the ovary and the corolla and stamens inserted on the calyx.

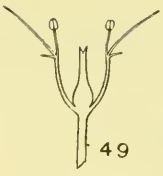
(a) Perigynous with superior ovary. Calyx free from the ovary, corolla and stamens inserted on calyx. (Fig. 49.)

(b) Perigynous with inferior ovary. Calyx adnate to the ovary, corolla and stamens inserted on the calyx tube above the ovary. (Fig. 50.)

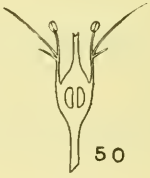
3. Flower epigynous. With the parts apparently inserted on the summit of the ovary. (Fig. 51.)

HYPOGYNOUS

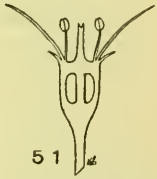
EPIPETALOUS HYPOGYNOUS



PERIGYNOUS SUPERIOR OVARY



PERIGYNOUS INFERIOR OVARY



EPIGYNOUS

TYPES OF FLOWERS

C. Union of parts.

1. Polypetalous, polysepalous. With the petals and sepals distinct.

2. Gamopetalous, gamosepalous. With the petals united; with the sepals united.

3. Monadelphous stamens. With the stamens united by their filaments into one set.

Variation in the flower — Concluded

C. Union of parts — Continued

4. Diadelphous stamens. With the stamens united by their filaments in two sets.
5. Syngenesious stamens. With the stamens united by their anthers into one structure, the filaments free.

D. Form of corolla.

1. Rotate. Wheel-shaped with the limb spreading at right angles.
2. Salverform. Tubular with the limb spreading at right angles.
3. Campanulate. Bell-shaped.
4. Urceolate. Cylindrical or ovoid and contracted in the throat like a vase.
5. Funnel-form. Tubular, with gradually spreading border.
6. Papilionaceous. Similar to the corolla of the Sweet Pea, consisting of a standard, two lateral wings and a keel (two petals).

FRUIT

General

The seed-bearing product of a seed plant is known as the fruit. In the Gymnosperms it is usually represented by a cone-like structure consisting of scales bearing seeds in their axils. (Fig. 54.) The fruit of Angiosperms is the ripened ovary with such structures as adhere closely to it. The classification of angiosperm fruits hinges on the proper interpretation of the structure of the pistil.

Criteria for the Interpretation of the Pistil

The upper (inner) cycle of modified leaves (carpels) which enter into the structure of a flower are designated by the collective term of gynoecium. A gynoecium may consist of but a single carpel or an aggregate of carpels. In the latter case the carpels may retain their individuality as separate simple pistils or they may cohere into a single structure, a compound pistil. A simple pistil consists of but a single carpel; a compound pistil is made up of two or more carpels. The following criteria may be used to separate simple and compound pistils:

1. Several styles or stigmas indicate a compound pistil of a like number of carpels. The reverse does not apply as several carpels may have completely cohered.

2. Several cells or locules generally indicate a like number of carpels. The reverse does not apply as a compound ovary may consist of but a single cell.

3. Several parietal placentae generally indicate a like number of carpels.

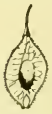
4. Dehiscent dry fruits, resulting from more than one carpel, generally open by a like number of sutures.

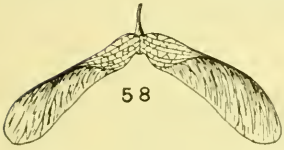
The wall of a ripened ovary is known as the pericarp. Within the pericarp are one or more ovule-bearing chambers or locules. A placenta denotes the line or surface within the ovary on which the ovules are borne. Placentae may be parietal (on the wall), basal, axile, or free central.

Classification of Angiosperm Fruits

A. Fruit classified as to the escape of seed from the ovary
   a. Dehiscent. Said of fruits which open at maturity to release the fruit. Paulownia (Fig 61).
   b. Indehiscent. Said of fruits which do not open at maturity to release the seed. Elm (Fig. 56).

B. Fruit classified as to texture
   a. Fleshy throughout or nearly so.
      1. Soft-fleshy throughout except the seed. Berry (Persimmon, Fig. 65).
      2. Fleshy throughout except the seed and the cartilagenous or leathery carpellary surfaces immediately surrounding the seed. Pome (Apple, Fig. 52).
   b. Fleshy without, bony within. Drupe (Cherry, Fig. 62).
   c. Dry.
      1. Indehiscent.
         (a) Winged. Samara (Elm, Fig. 56; Maple, Fig. 58).
         (b) Unwinged.
            (1) Bony or woody. Nut (Hickory, Fig. 66; Acorn, Fig. 63).
            (2) Coriaceous. Indehiscent dry fruit. (Basswood.)





TYPES OF FRUIT

Classification of Angiosperm Fruits — Continued

B. Fruit classified as to texture — Continued

2. Dehiscent.

a. As to number of ovaries or flowers.

(1) Opening by one suture. Follicle (Magnolia, Fig. 55).

(2) Opening by two sutures. Legume (Black locust, Fig 60).

(b) Formed from a compound pistil. Capsule (Paulownia, Fig. 61).

C. Fruit classified as to composition

a. As to number of ovaries or flowers.

1. Formed from one pistil. Simple fruit (Plum).

2. Formed from several pistils in one flower. Aggregate fruit (Tulip-tree fruit, Fig. 64).

3. Formed from several flowers or an inflorescence. Multiple fruit (Mulberry, Fig. 57; Figs. 53 and 59).

b. As to kind of parts.

1. Non-accessory. Consisting only of ovary or inferior ovary and adnate receptacle. (Apple, Fig. 52).

2. Accessory. Consisting of ovary and other parts which are not organically connected with it. (Osage Orange, Fig. 59).

General

WINTER CHARACTERS

With the approach of winter and the cessation of growth necessitated by it, biennial and perennial plants make definite provision to meet the rigors of the unfavorable season. Freezing temperatures have a drying effect on plant tissue in that the ice crystals start to form in the intercellular space (chinks) between cells rather than in the interior of the cell proper. Death may finally ensue through desiccation resulting from the removal of too much water from living cell contents as these crystals enlarge, rather than from the direct chilling action of low temperatures. Arborescent plants protect themselves from excessive transpiration during the winter months and resultant winter-killing as follows:

1. Leaf-fall.
2. Production of winter buds which are protected by bud-scales, gums, waxes, pubescence, etc.
3. Completion of growth in length and thickness and "hardening" of the new tissue ere cold weather sets in.
4. Increase in the osmotic pressure of cell sap, requiring lower temperatures to permit of the extraction of water from the cells.
5. Production of corky layers (periderm) on twigs and bole.

Growth in length versus Growth in Thickness

With the reawakening of growth in the spring, trees begin to grow in height and in thickness. Growth in thickness goes on throughout the whole length of the tree, including the roots, and has its inception in the activities of a growing layer (cambium) underlying the bark, the cells of which begin to divide and form new tissue. Growth in length is confined to the twig- and root-tips and results from buds which are either terminal or near the twig apices. As these buds unfold the embryonic parts contained within elongate and assume their final size. The number of new nodes and internodes resulting from the opening of a bud varies largely with the species and vigor of the individual. In some cases all of the growth for the following season is found in the embryonic condition in the bud and, as the bud opens, merely enlarges to its permanent size. In the majority of cases, however, there are a number of embryonic nodes and internodes included

in the bud, capped by a growing point which continues to form new nodes for a time, or during the remainder of the summer. By far the majority of the trees of the North Temperate Zone exhibit definite growth, which ceases by July or August after which no new growth in length takes place. In other instances the growth of the season may branch or longitudinal growth is indefinite and continues into the autumn until stopped by cold weather. In the latter case, the last formed parts, being soft and tender, are then usually winter-killed, resulting in a dead stub as in the case of the Staghorn Sumach.

New leaves are borne laterally at the nodes on the new growth, one or more as the case may be, and as early as June, the buds for the following season begin to form in their axils. By midsummer, on trees with definite growth, elongation of the new shoots has ceased, the buds have usually attained their full winter size, and the remainder of the season is devoted to the ageing of the new tisues, preparatory to withstanding the rigors of winter.

Leaf Fall

As autumn approaches, trees with deciduous leaves make ready for leaf-fall while in persistent leaves, metabolism ceases or is greatly inhibited and certain changes occur preparatory to the winter season. Prior to leaf-fall, an abscis or fission layer of loose cells forms across the base of the petiole at its place of insertion on the twig. This includes all the tissues at that point aside from the vascular bundles leading from the stem into the petiole (leaf-traces). Subsequently a corky layer (periderm) forms under the abscis layer and nature's preparations for leaf-fall are complete. With the advent of the autumn rains or the formation on frosty nights of ice crystals between the cells of the abscis layer which exert a prying action, the leaf eventually snaps off at the base of the petiole, leaving a leaf-scar protected by a coating of periderm.

Winter Habit

The winter habit, especially of those species in which the foliage is deciduous, is of diagnostic value in identification and many species can be distinguished at some distance by the experienced observer by this character alone. Two general types of branching of the trunk are recognized which, however, undergo many minor variations, the excurrent or upright, and the deliquescent or spreading. In the former, the primary axis or bole is con-

tinued, without interruption, entirely through the crown, and is prolonged annually by a terminal leader which produces laterals at intervals, usually in whorls or false whorls which give a more or less storied appearance to the crown. This type of branching is characteristic of the coniferous trees and a few broad-leaf trees and is an important feature because long, straight, tapering trunks are produced which yield the maximum amount of lumber. The second type is characterized by a trunk which, sooner or later, divides to form several large limbs which give rise to a broad, spreading crown, as in most of the broad-leaved trees. While many valuable timber trees are included in this class, they produce less merchantable lumber in proportion on conversion because there is a greater wastage in the crown. Both types exhibit many variations which are in part specific and in part the result of environment. Certain species in age develop a high, flat-topped, spreading crown; in others the crown is oblong or ovate and extends to within a few feet of the ground. The crown may be dense or open, consist of upright, horizontal or pendant branches which are either straight and rigid in habit or lax or zigzag and variously contorted. Moreover, the crown shape varies with age and the density of the stand. Many trees in youth possess a narrow, conical crown which becomes oblong, ovate or ovoid as they attain maturity. Trees growing in the open usually have a larger crown development than those in dense stands and often develop into the so-called "wolf" trees. The best timber is generally produced in dense stands. In conclusion we may say that every tree in the winter condition has certain eccentricities which betray its identity to the trained observer who is familiar with them.

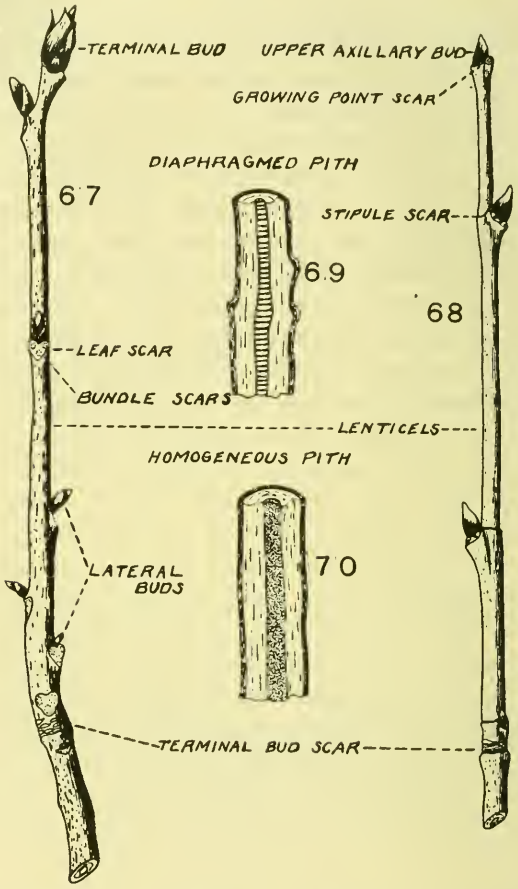
Winter Twigs

The study of twigs in winter conditions offers an entrancing subject to the student of trees and is an excellent training in the observation of details. The more important diagnostic features of winter twigs are buds, leaf-scars, bundle-scars, and color and character of the pith. (See Figs. 67–74.)

A. *Winter Buds*

A bud may be defined as an embryonic axis with its appendages. Many woody plants from the tropical rain forests where growth is practically continuous throughout the year, have buds which, as they are never truly dormant, are unprotected by typical

bud scales such as are found in the arborescent plants of the temperate regions, but sheathed with embryonic leaves which are in various stages of unfolding. In such plants there is no demand



Twig Characters

for protective devices in that the climate is continually warm and humid, and low temperature, with its resulting drying action, is unknown. In regions where a winter season necessitates a period of dormancy, or where there are distinct seasonal wet and dry periods, resting buds, generally protected by overlapping

scales, are characteristic structures of twigs and present many features which are of value in identification. Such buds may be classed as follows:

I. As to position.

a. Normal.

1. Terminal.* When terminal on the end of a twig. (Figs. 67 and 68.)
2. Axillary. When borne laterally on a twig in the axil of a leaf.

b. Adventitious. Abnormal buds produced under the stress of unusual conditions on any part of the root, stem, or leaf.

c. Accessory. Additional buds produced in addition to the normal bud.

1. Lateral accessory. Produced laterally, usually on either side of the normal bud.
2. Superposed. Produced above the normal bud.

Bud Dissection Showing Origin of Bud Scales

* Many woody plants are peculiar in developing pseudo-terminal buds. (Fig. 68.) Growth apparently continues into mid-summer until the available food supply is exhausted and the terminal growing point then withers and sloughs off, leaving a more or less circular scar with a ring of vascular tissue exposed. The last axillary bud then takes over the function of a terminal bud and continues the axis of growth. The result is a twig which is really a succession of branches developed by sympodial growth.

I. As to position— Continued

d. Subpetiolar. Buds which burst through leaf-scars or are enclosed in the hollow base of a leaf stalk and become visible only after leaf-fall. (Fig. 68.)

II. As to covering.

a. Scaly. Protected by scales which are valvate or overlap.

1. Laminar. When the bud-scales are modified leaf-blades (laminae). (Fig. 76.)
2. Petiolar. When the bud-scales are modified (flattened) leaf-stalks (petioles). (Fig. 77.)
3. Stipular. When the bud-scales are modified stipules. (Fig. 75.)

b. Naked. Devoid of scales, usually protected by hairs or down or by being sunk in the cortex.

The ideal time to study bud coverings is in the spring at the time of the inception of the new growth. Transition stages between typical leaf-parts and typical scales are often visible which indicate beyond question the origin of bud scales.

It follows that stipular bud scales are always found in pairs. Laminar and petiolar scales, inasmuch as they are leaf-parts proper, follow phyllotaxy. Plants with alternate leaves have alternate bud-scales of either of these types and the same applies to opposite-leaved plants. The number of bud-scales to a bud varies widely in different plants, but is fairly constant within the species.

III. As to contents.

a. Leaf-buds. Buds containing only the rudiments of leaves.

b. Flower-buds. Buds containing only the rudiments of flowers or inflorescences.

c. Mixed buds. Buds containing the rudiments of both leaves and flowers.

IV. As to dormancy.

a. Active. Buds which develop the spring following their formation. Usually toward the top of the growth of the season.

b. Dormant. Buds which remain dormant except under the stress of exceptional conditions such as defoliation. Usually near the base of the growth of the season.

B. *Leaf-scars and Stipule-scars*

Leaf-scars are the scars on twigs which result from leaf-fall and of necessity have the same arrangement as leaves. (Fig. 67.) As pointed out in previous paragraphs, the fall of leaves in deciduous species is a normal physiological process for which nature makes preparation some days in advance. Leaf-scars vary greatly in contour, size, and elevation above the surface of the twig and are important features in twig identification. They vary widely in shape from narrowly V-shaped, linear, or lunate to semicircular, cordate and elliptical. The narrow forms may extend nearly or quite around the twig while the broad forms are usually confined wholly to one side. The size varies greatly in different kinds of trees. Trees with stout twigs, as Ailanthus, are usually characterized by large leaf-scars, while in other forms with slender twigs like some of the cherries, they are so small as to render them difficult of detailed observation without a pocket lens. Where leaf-scars are elevated above the surface of the twig owing to the elevation of the abscise layer, they are said to be decurrent on the twig, an expression which has been coined to indicate the somewhat fluted appearance of the twig immediately beneath the leaf-scar. Leaf-scars remain visible on twigs for a number of years but eventually slough off as new bark is formed beneath them by the enlarging branch.

On many twigs leaf-scars are accompanied by stipule-scars (Fig. 68) which are inserted laterally to the leaf-scars and assume various shapes. In other cases stipules are either wanting or speedily fugacious and leave no permanent traces on the stem. Where present, stipule-scars, like leaf-scars, vary in contour and may be triangular, semi-circular, etc. In trees like the Sycamore (Fig. 68) they extend around the stem obliquely and meet in a point on the back. Stipular thorns are features of the winter twigs of certain species and offer a ready means of identification.

C. *Vascular bundle scars*

Vascular bundle-scars, generally termed "bundle-scars," are found included in the boundaries of leaf, stipule, and "growing point-scars". (Figs. 67 and 68.) In stipule-scars they are generally so minute and indistinct as to be of no diagnostic value whatsoever. "Growing point-scars," that is, the scar resulting from the sloughing off of the growing point in woody plants of determinate growth, have vascular scars which are circular in

outline with pith in the center. The grouping of bundle-scars within leaf-scars is of decided diagnostic value and constant within the species. The number of bundle-scars may vary from one to thirty or more. Many plants possess three prominent scars. In others the number is larger and they are irregularly scattered, arranged in three groups, in a single lunate line, in the form of an ellipse, etc., within the boundaries of the leaf-scar. Bundle-scars consist of vascular tissue (leaf-traces) which extended from the stem into the leaf and were ruptured and exposed to view at the time of leaf-abscission.

D. *Color of Twigs*

The color of twigs is very variable and caution must be employed in using this feature in identification. The colors range from nearly black through shades of green, red and brown, to gray or nearly white. Often the color of a portion of a twig depends upon its exposure. For example, in Basswood the upper part of the twig which is exposed to direct insolation is of a decided reddish cast, while the bark of the lower side is generally olive-green. Subsequently all twigs usually darken with age and eventually assume the hues of the mature bark. Some twigs are dull, others are lustrous or glaucous, that is, provided with a waxy bloom which rubs off. Many are smooth while others are granular, scabrous, or develop corky excrescences or wings, the function of which is uncertain. All grades of hairiness prevail from the pilose type with long, soft hairs, through hirsute, pubescent, and tomentose, and are characteristic features of certain species.

E. *Taste and Odor of Twigs*

Supplementing the color characteristics of twigs is that of taste and odor. Cherry twigs have the odor and taste of bitter almonds. The flavor of Sassafras can be detected in the twigs of that species. Black and Yellow Birch contain an ethereal oil of wintergreen odor and taste. Hop-tree and Nannyberry possess twigs which give off a disagreeable odor when broken. The twigs of Silver Maple are distinguished from those of the Red Maple by their rank odor. In employing such characters for identification care must be taken not to include the twigs of Poison Sumach or Poison Oak as they would lead to unfortunate results.

F. *Lenticels*

An external feature of twigs which is of minor value in identification is the presence of lenticels (Figs. 67 and 68) which vary greatly in number, size, and color. Lenticels are organs of aeration which nature has provided to insure a supply of oxygen to tissues underlying the corky periderm. These often contain chlorophyll which is active in the elaboration of plant food; in any case the living cells making up these tissues require oxygen for their maintenance. The initial covering of all twigs is known as the epidermis or outer skin. It is usually a single layer of cells, the outer walls of which are covered with a special waterproofing material known as cutin, and has, as its chief function, the protection from desiccation of the deeper lying tissues. In most woody plants the epidermis is comparatively short lived and no provision is made for its expansion to accommodate the enlarging twig; it ruptures and sloughs off the second or third year. It is at this time that many twigs are covered with a gray, evanescent skin, the old epidermis, which is no longer a functional part of the tree but still clings to the twig. But prior to the rupturing of the epidermis, a new water-and air-proof layer, several cells in thickness, has arisen from the renewed division of cells underlying the epidermis. This is known as periderm and assumes the protective functions of the epidermis after the latter is ruptured. The cells of the periderm are strongly suberized, that is, corky, and are quite impervious to the passage of air or moisture, but here and there breaks in the continuity of the corky layer occur which consist of unsuberized, loosely attached cells, the so-called lenticels.

Lenticels make their appearance on the new growth during the first summer soon after the unfolding of the new leaves. In some species they are relatively abundant and conspicuous structures and stand out clearly against the green background of the young stem, while in others they are sparse and relatively inconspicuous. At this stage they are usually punctate and orbicular in outline or somewhat elongated, either vertically or longitudinally and vary in color from white through shades of orange, brown and pink, to nearly black. Lenticels are generally uniformly distributed over the surface of the twig but in some cases there is a tendency toward aggregation below nodes or on the underside of twigs. As the twigs mature into branches and larger limbs, lenticels finally disappear owing to the exfoliation of the bark

but in such ringbarked species as Birch and Cherry they may persist for many years as enlarged and horizontally elongated bodies which measure an inch or more in length.

G. *Pith*

With the exception of the tree ferns, the arborescent Monocotyledons, certain of the primitive Gymnosperms of dendroid habit, and scattered dicotyledonous species, trees are characterized by woody stems which possess a central pith or medulla and radial symmetry, and thicken by the addition of yearly increments which take the form of annual or seasonal rings as seen in cross section. The pith differs from the wood not merely in position but in the nature of the cells which constitute it. These are usually more or less globose or isogonal, often thin-walled and rather loosely aggregated, and reflect the light differently as seen in cross-sections of the twig. The function of pith is in doubt. In twigs or small branches it undoubtedly acts as a storage organ for reserve food during the winter but in older organs it apparently has no such function and remains as an obsolete tissue surrounded by heart wood.

The value of the pith in twig identification lies in its consistency, shape, and color. In the majority of woody plants it is homogeneous (Fig. 70) as seen in vertical section without cross-partitions or interruptions of any kind. In other cases it may have disappeared entirely leaving a hollow stem although this is unusual in trees but is commonly found in shrubs such as the Elders and Honeysuckles. The Black Walnut and Butternut have a diaphragmed or chambered pith (Fig. 69) which consists of many thin dissepiments spanning the pith cavity at brief intervals. Other trees such as the Hackberry and Tupelo possess a diaphragmed-stuffed pith in which the soft, homogeneous tissue which fills most of the pith cavity is interrupted by plates of denser tissue (stone cells).

The outline of the pith in cross-section varies in different kinds of trees, a character which may sometimes be used in their identification. Oaks, Chestnut, and Aspens are characterized by a star-shaped or 5-angled pith (Fig. 73), while the medulla is 3-angled in Alder (Fig. 74), features related respectively to 2/5 and ⅓ phyllotaxies. In many species such as the Elm and the Magnolia the outline is circular (Fig. 71) or somewhat lopsided as in Basswood. (Fig. 72.) The size and color of the pith, especially in

coarse branches, may be conspicuous twig features. Ailanthus and Kentucky Coffee Tree both have stout twigs with conspicuous medulla, but in the first case it is ochraceous, while that of the Kentucky Coffee Tree is salmon pink. In different woody plants the color varies from white to pale or dark brown, with shades of pink, red or pale green as the exception, rather than the rule.

H. *Bark*

The most important feature in the identification of standing trees in winter is the bark, though one of the most difficult to describe. Bark characteristics can best be taught by the visual method, by actual studies in the field supplemented by photographs and lantern slides.

In the preceding pages mention was made of the fact that the epidermis, as found in twigs, rarely functions for more than one year, but is soon replaced by a corky layer or periderm which takes over the protective function. The first layer of periderm is usually superficial in origin and has its inception in the layer of cortex immediately underlying the epidermis. It continues to function for a long period, often for 20–40 years, provision being made for the increase in girth through the additions of new layers from the dividing cells underneath and the imperceptible sloughing off of cell particles from without. Sooner or later deeper cork formation begins and is immediately evinced by a roughening of the bark due to the desiccation and death of deeper-lying tissues. Deep cork formation may result from new periderms concentric with the first and give rise to ringed bark, as in Cherry and Birch, but in the majority of cases the new corky layers are in the form of arcs which encroach into the living tissues for varying distances. The thickness of bark varies greatly between species and individuals and depends largely on such factors as (1) the rapidity of formation, (2) time of the beginning of exfoliation, and (3) the rate of exfoliation. Ash, *Platanus* and Osage Orange are thin barked; and in most of the Oaks and Black Locust the bark is thick. It is due to the many minor variations in the time and manner of deep cork formation, the time of exfoliation, as well as the organic content of the tissues concerned that trees have bark characteristic of the species.

Some species have very rough bark with deep longitudinal fissures, as in the Chestnut, Oak and Black Locust. In others the longitudinal fissures are comparatively shallow and are separated

by acute or flat-topped, anastomosing ridges, as in Ash or Butternut. In some of the Hickories, the shellbarked species, the bark exfoliates in broad plates, while in the Hornbeam it is finely shreddy. Beech and Blue Beech are characterized by a smooth bark which fails to become rough, even with age. The bark of some of the Cherries and Birches is comparatively smooth and marked with prominent horizontal lenticels. Dogwood, Persimmon, and Black Gum exhibit the so-called alligator bark, the vertical ridges being interrupted by horizontal fissures which give the appearance of alligator skin. Hackberry is rough-barked and in addition, often has gnarly excrescences. In many cases it is difficult to put into words the distinctions which characterize the bark of various species though they may be readily separated in the field.

The color of bark is extremely variable, both between species and under different conditions of age, height, or location in the same species. In many cases these variations between individuals are puzzling to the novice and require a knowledge of the range of variation to decipher species. The prevailing colors are gray, brown, or black, but red and white bark are features of certain trees. In general the mature bark is darker than that of the branches and limbs, but exceptions to this occur. Moreover, the color of the inner bark is likewise characteristic of certain species. The inner bark of the Black Oak (*Quercus velutina*) is yellow, while that of Hemlock is purplish red. Butternut has a yellow inner bark from which a yellow dye may be obtained. The bark of many species is a source of valuable forest products such as tannin, paper and rope fibers, dyes and cork.

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* The interpretation of the structures which enter into the fruit is of necessity more or less arbitrary. A compound fruit is here interpreted as one arising from several pistils in the same flower or from a cluster of flowers which in fruit give rise to structures which cohere or at least overlap.

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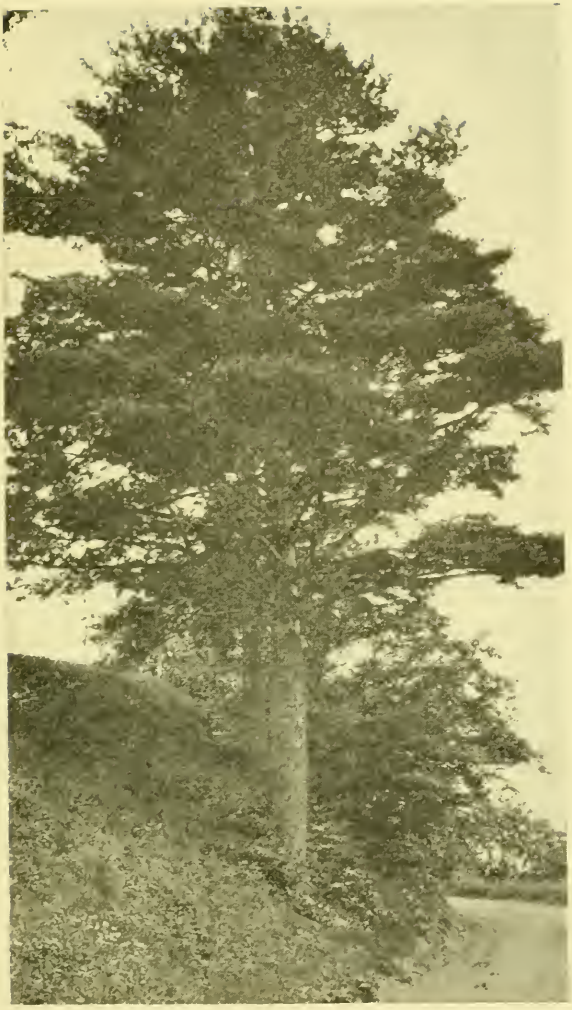


I think that I shall never see
A poem lovely as a tree.

A tree whose hungry mouth is pressed
Against the earth's sweet flowing breast;

A tree that looks at God all day
And lifts her leafy arms to pray;

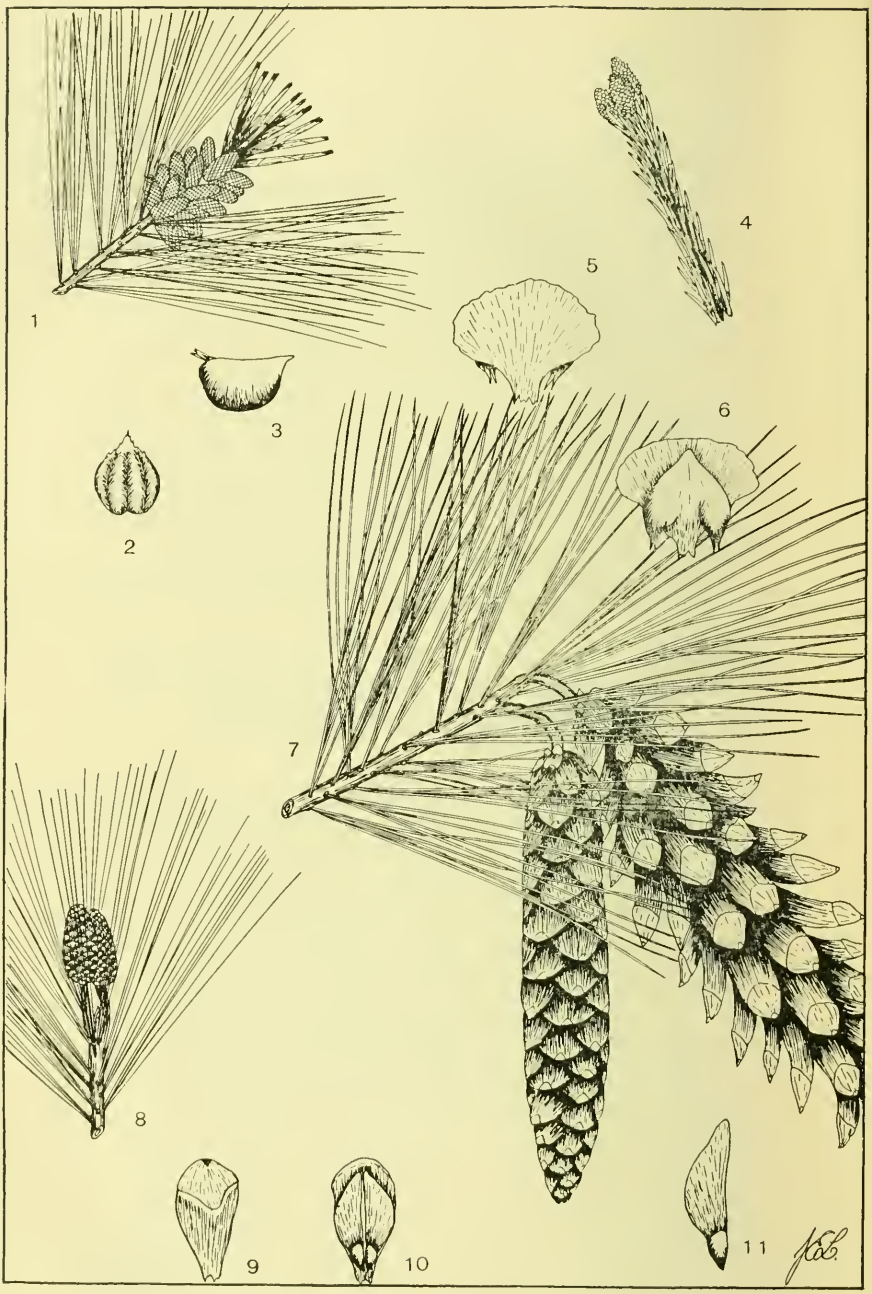
A tree that may in summer wear
A nest of robins in her hair;

Upon whose bosom snow has lain;
Who intimately lives with rain.

Poems are made by fools like me,
But only God can make a tree.

By JOYCE KILMER

PLATES WITH LEGENDS AND TABULATED DESCRIPTIVE INFORMATION



White Pine, Weymouth Pine

Pinus Strobus L.

1. A branch with staminate flowers x ½
2. A stamen, front view x 5
3. A stamen, lateral view x 5
4. A branch with ovulate flowers x ½
5. Cover-scale, lower side x 10
6. Ovuliferous and cover-scale, upper side, showing ovules x 10
7. A fruiting branch, showing mature cones, second year x ½
8. A fruiting branch, showing cones, first year x ½
9. Scale from mature cone, lower side x ½
10. Scale from mature cone, upper side, showing seeds x ½
11. Winged seed x 1

PINACEAE

Pinus Strobus L.

White Pine, Weymouth Pine

Habit — The tallest conifer of New York State, rarely at maturity attaining a height of 150 feet, usually 80 to 110 feet in height, with a trunk diameter of 3–4 feet. Trees growing in dense stands have small crowns with boles with little taper and free from branches for a long distance above the ground. In the open the crown is large and broadly conical; the bole is often forked, tapers abruptly, and bears whorls of branches (usually in fives) which persist nearly to the ground.

Leaves — Borne in fascicles of 5, needle-shaped, 3-sided, soft and flexible, bluish-green, 3–5 inches long. New leaves at first surrounded by a deciduous sheath, attaining full size during August, and persisting through the second, rarely to the third season.

Flowers — Appearing in late May or early June, monoecious, borne in cones. Staminate cones clustered at the base of the growth of the season, about ⅓ of an inch long, oval and yellow at maturity. Ovulate cones solitary or in small groups near the top of the growth of the season, oblong-cylindric, about ½ of an inch in length, stalked, upright, pinkish purple at pollination.

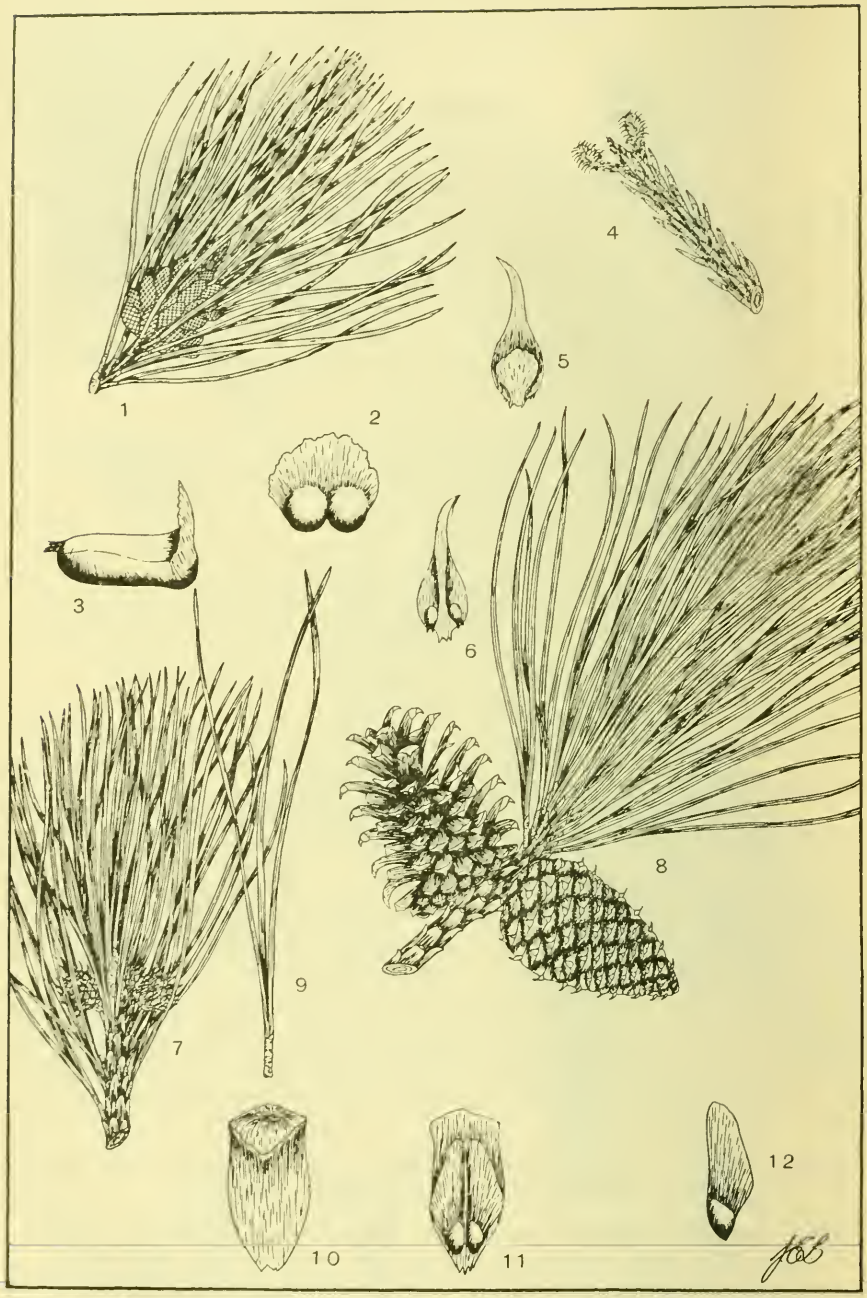
Fruit — A cylindrical green cone, 5 to 10 inches long, long-stalked and pendant, attaining full size during July of the second year, turning brown and opening in the autumn. Opened cones fall during the winter and following spring. Cone-scales thin, but slightly thickened at the apex, unarmed. Seeds reddish-brown, winged, about ¼ of an inch long.

Winter characters — Branchlets slender, at first green and coated with rusty tomentum, later smooth and light orange-brown and roughened by the fascicle-scars. Buds ¼–½ of an inch in length, ovate-oblong, acuminate, with many long-pointed and overlapping scales. Mature bark dark gray, thick, divided by shallow fissures into broad, continuous ridges.

Habitat — Prefers rich, moist, well-drained soils, but thrives on sandy and gravelly sites. Found in a wide range of habitats. Forms nearly pure stands in many localities; in others in small groves intermixed with deciduous species.

Range — Eastern Canada, Maine to Minnesota, south along the Alleghany Mountains to northern Georgia. Zones A, **B**, **C**, and D.

Uses — The most important timber tree of the northeastern states. Wood light, soft, weak, resinous, straight-grained, easily worked, light brown, occasionally with a tinge of red, with thin, whitish sapwood. Used for a great variety of purposes where a soft, easily-worked wood is desired. White pine is of rapid growth, responds readily to propagation, and is widely used in reforestation. Planted both here and abroad (Weymouth Pine) for shade and ornament.



Pitch Pine

Pinus rigida Mill.

1. A branch with staminate flowers x ½
2. A stamen, front view x 5
3. A stamen, lateral view x 5
4. A branch with ovulate flowers x ½
5. Cover and ovuliferous scale, lower side x 15
6. Ovuliferous scale, upper side, showing ovules x 15
7. A fruiting branch showing cones, first year x ½
8. A fruiting branch showing mature cones, second year x ½
9. A fascicle showing needles x 1
10. Scale from mature cone, lower side x 1
11. Scale from mature cone, upper side, showing seeds x 1
12. Winged seed x 1

PINACEAE

Pinus rigida Mill.

Pitch Pine

Habit — A tree occasionally 70–80 feet in height, usually 40–60 feet tall, with a trunk diameter of 2–3 feet. Crown in young trees narrowly pyramidal and open, the horizontal branches stout, rigid, produced in regular, rather distant whorls. In old trees the crown becomes irregular, thin and rounded, consisting of coarse, gnarled branches, often pendulous at the tip, bearing tufts of yellow-green foliage.

Leaves — Borne in fascicles of 3, needle-shaped, sharply serrulate, stout, blunt-pointed, rigid, yellowish green, 3–5 inches long, divergent from a short sheath, falling during the second or third season.

Flowers — Appearing in May and early June, monoecious, borne in cones. Staminate cones, clustered at the base of the growth of the season, about ¾ of an inch long, cylindrical, somewhat flexuous, yellow at maturity. Ovulate cones solitary or clustered, lateral near the top of the growth of the season, subglobose, about ½ of an inch long, borne on short, stout stalks, upright and reddish green at pollination. Scales acuminate, divergent.

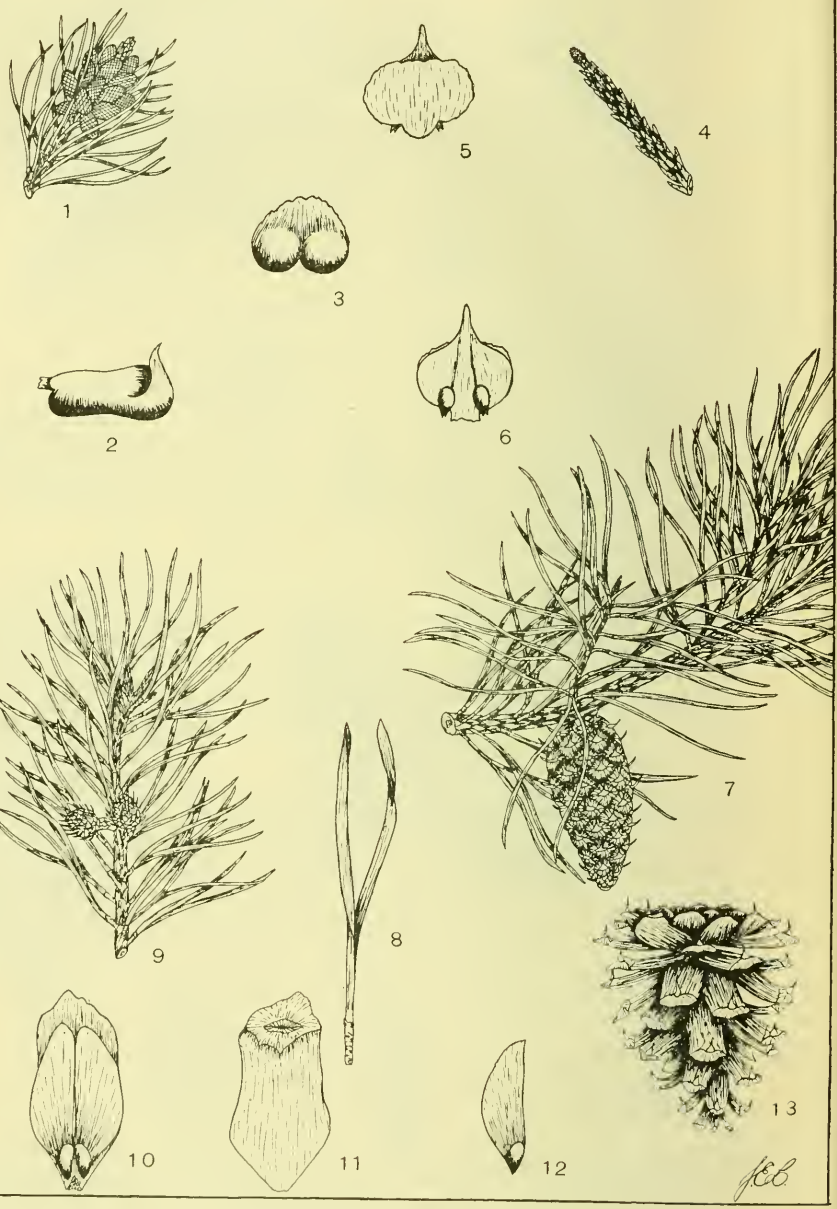
Fruit — An ovate-conical or ovoid, prickly, green cone, 1 to 3 inches long, sessile or nearly so, usually at right angles to the branch, attaining full size during early autumn of the second year, opening tardily during the late fall and winter, and remaining on the trees for a decade or more. Cone-scales thickened at the apex, armed with a short, rigid, recurved prickle. Seeds dark brown or dull black, winged, about ¼ of an inch long.

Winter characters — Branchlets stout, roughened by the persistent, decurrent leaf-bases of the scale-leaves which subtended the fascicles, at first dull orange, later dark grayish brown. Buds ½–¾ of an inch long, ovate or obovate-oblong, acute, with lanceolate, dark chestnut-brown scales, scarious and fringed at the margins. Mature bark dark reddish brown, thick, divided by deep furrows into broad, flat-topped ridges.

Habitat — Occurs on gravelly uplands and sandy plains, rarely in cold swamps. Thrives well on barren sandy sites. Common in the north on glacial soils.

Range — New Brunswick to Lake Ontario, south in the Atlantic States to northern Georgia, and west into West Virginia, Tennessee and Kentucky. Zones **B** and **C**.

Uses — Of less importance than White or Red Pine as a source of lumber. Wood light, soft, coarse-grained, brittle, light brown or red, with thick yellowish-white sapwood. Occasionally converted into lumber. Of some value in reforestation because of its adaptability to poor soils and its fire-resisting qualities (thick, corky bark). Mature trees generally have a picturesque appearance.



Scrub Pine, Jersey Pine

Pinus virginiana Mill. [Pinus inops Ait.]

1. A branch with staminate flowers x ½
2. A stamen, lateral view x 10
3. A stamen, front view x 10
4. A branch with ovulate flowers x ½
5. Cover-scale, lower side x 10
6. Ovuliferous scale, upper side, showing ovules x 10
7. A fruiting branch showing a mature cone, second year x ½
8. A fascicle showing needles x ½
9. A fruiting branch, showing cones, first year x ½
10. Scale from mature cone, upper side, showing seeds x 1
11. Scale from mature cone, lower side, x 1
12. Winged seed x 1
13. Mature cone, after seed dispersal x ¼

PINACEAE

Pinus virginiana Mill. [Pinus inops Ait.]

Scrub Pine, Jersey Pine

Habit — In New York State, a small tree usually 30–40 feet in height, with short trunk rarely more than 18 inches in diameter. Farther south and west it occasionally attains a height of 100 feet, with a trunk 2–3 feet in diameter. Crown in young trees pyramidal, reaching to the ground; in older trees open, flat-topped, pyramidal, with long horizontal or pendulous branches in remote whorls.

Leaves — Borne in fascicles of 2, needle-shaped, semi-cylindrical, rather stout, closely serrulate, acute, soft and flexible, generally twisted and divergent, bright green and fragrant, 1½–3 inches long, persisting three or four years.

Flowers — Appearing in April and May, monoecious, borne in cones. Staminate cones in crowded clusters at the base of the growth of the season, about ⅓ of an inch long, oblong, pale orange-brown at maturity. Ovulate cones solitary or paired near the middle of the growth of the season, subglobose, about ⅓ of an inch long, long-pedunculate, pale green tinged with rose.

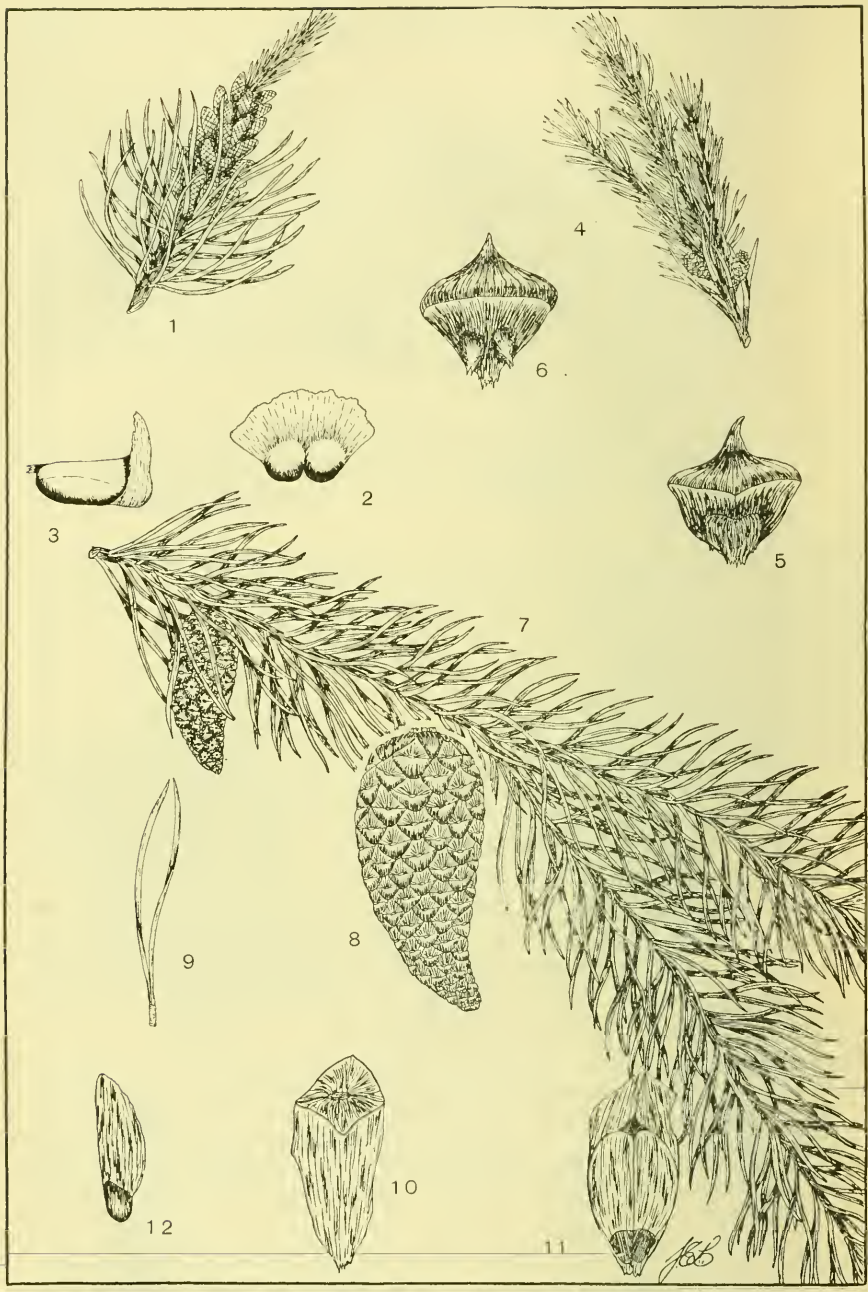
Fruit — An oblong-conical, prickly, bright green cone, 2–3 inches long, erect, nearly sessile, often slightly curved, attaining full size the second autumn, turning dark reddish-brown, and slowly setting free the seeds. Opened cones persist on the branches for 3–4 years. Cone-scales thin, flattened, thickened at the apex, and terminated by a prickle. Seeds pale brown, winged, about ⅓ of an inch long.

Winter characters — Branchlets slender, tough, rather flexible, at first glaucous and greenish purple, at length grayish brown. Buds ⅓–½ of an inch in length, ovate, acute, with ovate, acute, dark chestnut-brown scales, the scale-tips soon reflexed. Mature bark dark brown tinged with red, thin, shallowly fissured with scale-like plates.

Habitat — Thrives on poor, sandy soils, spreading rapidly over abandoned fields and cut-over areas. Frequent on the sand-barrens of New Jersey.

Range — Long Island and Staten Island, New York, south through eastern Pennsylvania to Georgia and Alabama, west to Indiana, Kentucky and Tennessee. Attains its best development west of the Alleghany Mountains. Zone A.

Uses — Of little value as a timber tree in the east because of its small size. Wood light, soft, brittle, coarse-grained, durable in contact with the soil, pale orange with thick, nearly white sapwood. Used for fuel and occasionally converted into lumber. In reforestation, important as a "cover" tree because of its rapid regeneration on exhausted lands. Of little ornamental value.



Jack Pine, Gray Pine, Scrub Pine

Pinus Banksiana Lamb. [Pinus divaricata (Ait.) Du Mont de Cours]

1. A branch with staminate flowers x ½
2. A stamen, front view x 15
3. A stamen, lateral view x 15
4. A branch with ovulate flowers x ½
5. Cover and ovuliferous scale, lower side x 15
6. Ovuliferous scale, upper side, showing ovules x 15
7. A fruiting branch showing mature cone, second year x ½
8. Mature cone x 1
9. A fascicle showing needles x 1½
10. Scale from mature cone, lower side x 1½
11. Scale from mature cone, upper side, showing seeds x 1½
12. Winged seed x 1½

PINACEAE

Pinus Banksiana Lamb. [Pinus divaricata (Ait.) Du Mont de Cours]

Jack Pine, Gray Pine, Scrub Pine

Habit — Usually a small tree 15–40 feet in height, with a trunk diameter of 9 to 15 inches and a scrubby, stunted, irregular crown which often extends to the ground. At its optimum range it becomes 70 feet in height, with a straight trunk free from branches for twenty or more feet. Gnarly, scraggly specimens common on poor soils. Branches large, spreading, characteristically clothed with short needles and incurved cones.

Leaves — Borne in fascicles of 2, needle-shaped, semi-cylindrical, stout, stiff, generally curved and twisted, dark green, ¾–1¼ inches long, falling gradually during the second and third years. Fascicle-sheath short and persistent.

Flowers — Appearing in May and June, monoecious, borne in cones. Staminate cones in crowded clusters at the base of the growth of the season, about ½ of an inch long, oblong, yellow at maturity. Ovulate cones in clusters of 2–4, borne laterally on the shoots of the season (often two clusters to a shoot), subglobose, about ¼ of an inch long, upright, stalked, dark purple at pollination.

Fruits — An oblong-conical, dull purple or green cone, 1½–2 inches long, sessile, erect, and strongly curved, attaining full size the second autumn, turning light yellow and remaining closed for several years. Cones persist on the branches for a decade or more. Cone-scales thickened at the apex, armed with minute, incurved, often deciduous prickles. Seeds dark brownish black, winged, about ⅜ of an inch long.

Winter characters — Branchlets slender, roughened by the persistent, decurrent bases of the scale-leaves, at first pale yellowish green, at length becoming dark purplish brown. Buds ⅛–¼ of an inch long, ovate, blunt, with ovate-lanceolate, pale chestnut-brown scales with spreading tips. Mature bark dark brown slightly tinged with red, thin, divided irregularly into narrow, rounded ridges, scaly on the surface.

Habitat — Found on sterile sandy soils and rocky ridges, more rarely on lowlands and boggy plains. Often covers great tracts of barren lands and sand dunes, mingling with other stunted trees.

Range — Nova Scotia westward to the North West Territory and British Columbia, south to northern New England, New York, Michigan, northern Illinois and central Minnesota. Of largest size in the region north of Lake Superior. Zones C and **D.**

Uses — Of little importance as a timber tree. Wood light, soft, weak, close-grained, pale brown to orange in color with a thick white sapwood. Used for pulp in admixture with other woods. Occasionally manufactured into lumber, railroad ties, etc.

Short-leaved Pine, Yellow Pine

Pinus echinata Mill. [Pinus mitis Michx.]

1. A branch with staminate flowers x ½
2. A stamen, lateral view x 10
3. A stamen, front view x 10
4. A branch with ovulate flowers x ½
5. Cover and ovuliferous scale, lower side x 8
6. Ovuliferous scale, upper side, showing ovules x 8
7. A fruiting branch showing mature cones, second year x ½
8. A fascicle showing three needles x ½
9. A fascicle showing two needles x ½
10. A fruiting branch showing cones, first year x ½
11. Scale from mature cone, lower side x 1
12. Scale from mature cone, upper side, showing seeds x 1
13. Winged seed x 1

PINACEAE

Pinus echinata Mill. [Pinus mitis Michx.]

Short-leaved Pine, Yellow Pine

Habit — A tree at maturity attaining a height of 80–100 feet, occasionally 120 feet, with a trunk diameter of 3–4 feet. Crown broad, pyramidal, truncate, consisting of slender, somewhat pendulous, very brittle branches. Trunk long, clean, somewhat tapering.

Leaves — Borne in fascicles of 2–3 (rarely 4), needle-shaped, closely serrulate, abruptly pointed, soft and flexible, dark bluish green, 3–5 inches long, persisting from two to five years.

Flowers — Appearing in April and May, monoecious, borne in cones, Staminate cones clustered at the base of the growth of the season, nearly sessile, about ¾ of an inch long, oblong-cylindrical, pale purple at maturity. Ovulate cones usually in pairs or clusters of three or four, rarely solitary, subterminal on the growth of the season, oblong to subglobose, about ⅛ of an inch long, on stout ascending stalks, pale rose-colored at pollination.

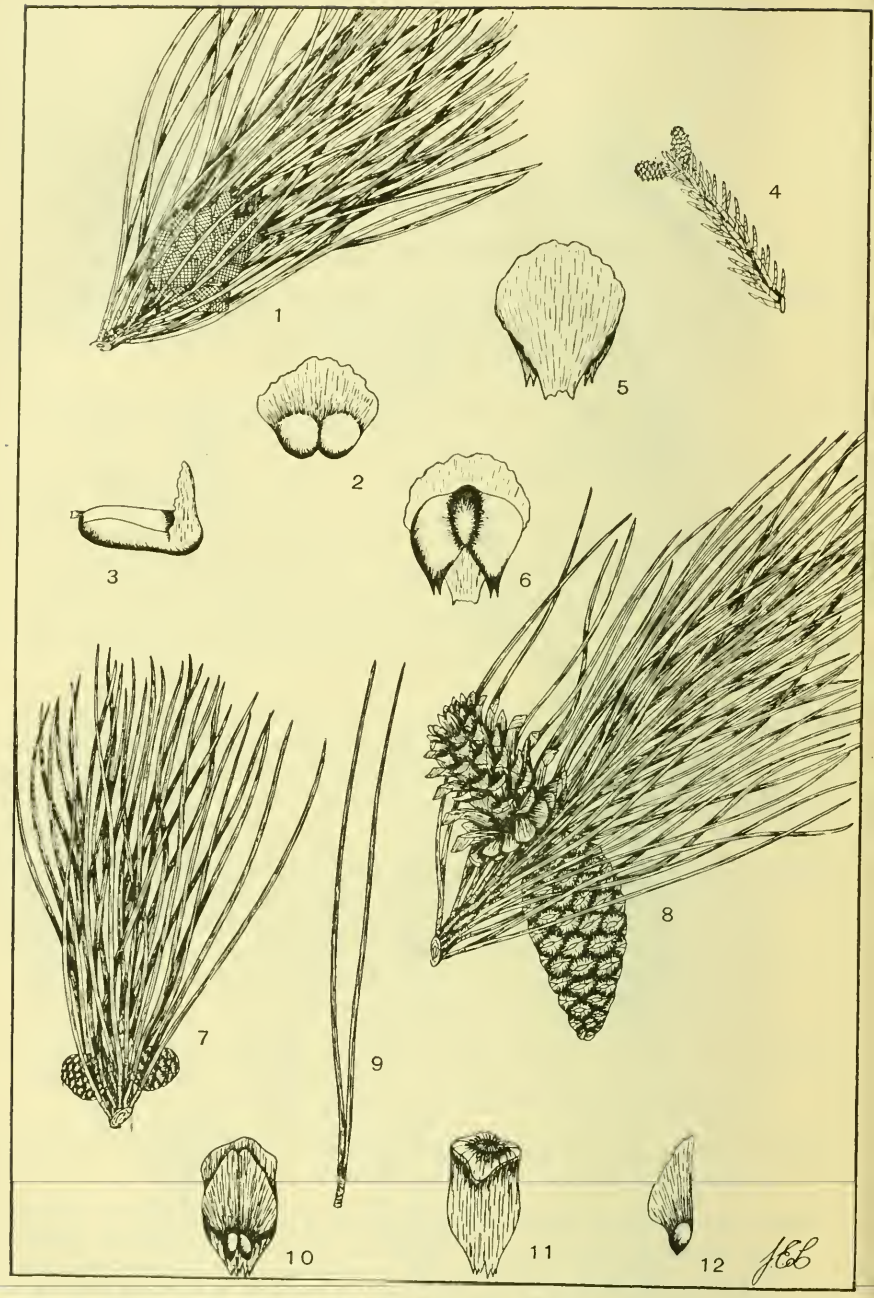
Fruit — An ovate or oblong-conical, chestnut-brown cone, 1½–2 inches long, subsessile, horizontal or pendant, attaining full size and maturity during the second autumn. Opened cones persist on the branches for several years. Cone-scales with slightly thickened ends, equipped with weak, usually deciduous prickles.

Winter characters — Branchlets stout, brittle, somewhat rough, at first pale green or violet, glaucous, later dark reddish brown and scaly. Buds ⅛–¼ of an inch long, ovate, obtuse, with ovate-lanceolate, closely imbricated, chestnut-brown scales which are divided above the middle into matted filaments. Mature bark dark brown tinged with red, divided by fissures into irregular, scaly, angular plates.

Habitat — Occurs on a wide range of sites on plains, foothills, and tablelands. Thrives on poor clayey and sandy soils. Grows in pure stands or intermixed with hardwoods, generally the latter in the east.

Range — Staten Island, New York, Pennsylvania, south to Georgia, and west to Missouri, Oklahoma and Texas. Zone A.

Uses — An important timber species, ranking second in importance among the Southern Yellow Pines. Wood heavy, heard, strong, resinous, coarse-grained, variable in quality, orange or yellowish brown in color with pale white sapwood. Largely manufactured into lumber for a variety of purposes. Within its natural range valuable in reforestation because of the ease of self-generation.



Red Pine, Norway Pine

Pinus resinosa Ait.

1. A branch with staminate flowers x ½
2. A stamen, front view x 5
3. A stamen, lateral view x 5
4. A branch with ovulate flowers x ½
5. Cover-scale, lower side x 15
6. Ovuliferous and cover-scale, upper side, showing ovules x 15
7. A fruiting branch showing cones, first year x ½
8. A fruiting branch showing mature cones, second year x ½
9. A fascicle showing needles x ½
10. Scale from mature cone, upper side, showing seeds x 1
11. Scale from mature cone, lower side x 1
12. Winged seed x 1

PINACEAE

Pinus resinosa Ait.

Red Pine, Norway Pine

Habit — A tree, usually 50–75 feet in height, occasionally 100 feet, with a trunk diameter of 2–3 feet. Crown at first broadly pyramidal, with stout, thick-spreading branches which are more or less pendulous and clothe the bole to the ground, in age forming an open, round-topped head.

Leaves — Borne in fascicles of 2, needle-shaped, semi-cylindrical, soft and flexible, dark green and shining, 4–6 inches long, falling during the fourth and fifth season. Fascicle-sheaths persistent.

Flowers — Appearing in May and early in June, monoecious, borne in cones. Staminate cones in dense clusters at the base of the growth of the season, solitary or in whorls of 2–3 near the top of the growth of the season, subglobose, about ¼ of an inch long, stalked, upright, scarlet at pollination.

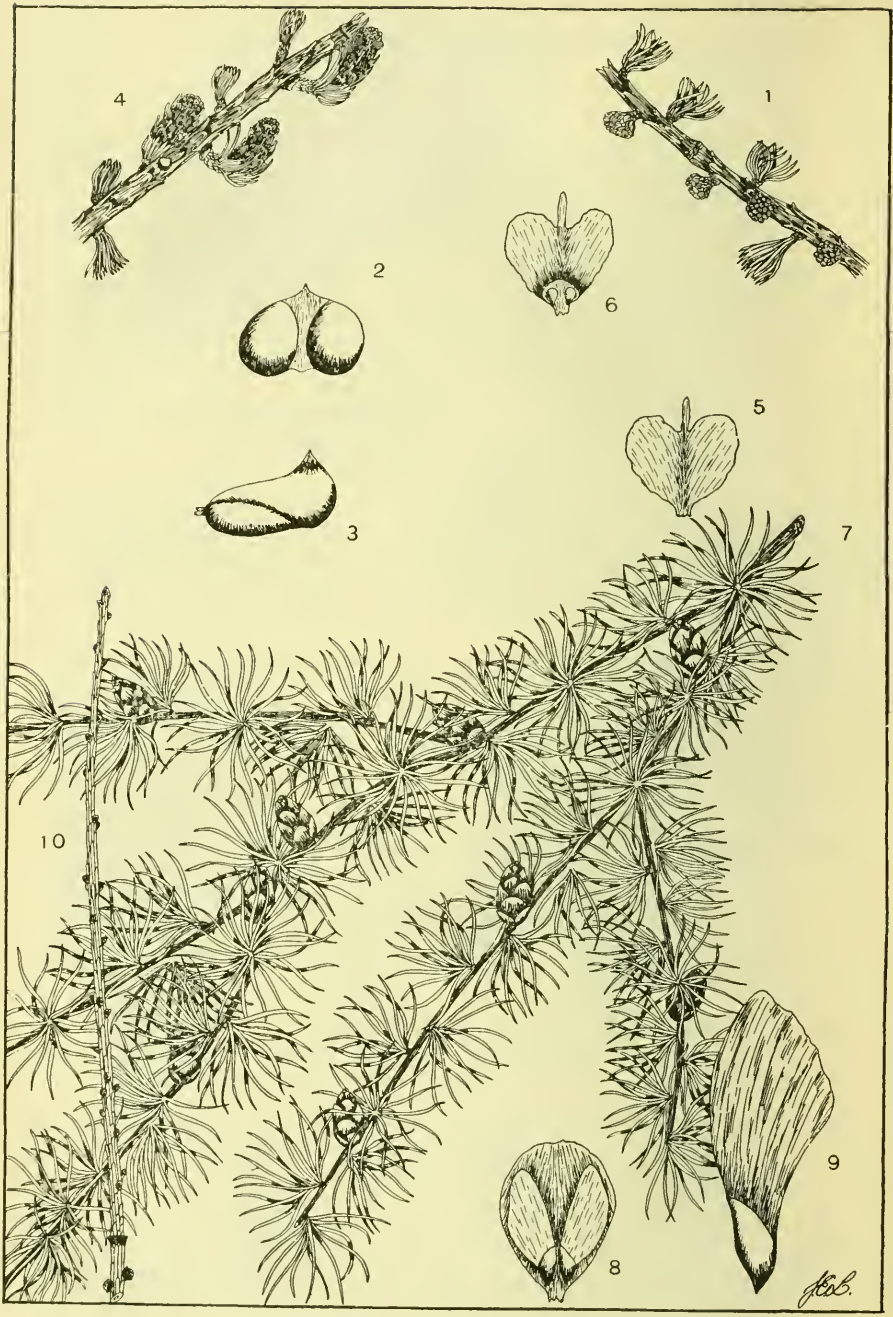
Fruit — An ovate-conical, green cone, 2–2½ inches long, subsessile, horizontal, attaining full size during the second summer, turning light chestnut-brown and opening in the autumn. Opened cones persist on the branches until the following season. Cone-scales with slightly thickened and ridged end, unarmed. Seeds dark chestnut-brown, winged, about ⅛ of an inch long.

Winter characters — Branchlets stout, roughened by the persistent bases of the leaf-buds, at first orange in color, when older, light reddish brown. Buds ½–¾ of an inch long, ovate, acute, with lanceolate, loosely imbricated, chestnut-brown scales, white and fringed on the margins. Mature bark light reddish brown, thick, divided by shallow fissures into broad, flat ridges.

Habitat — Thrives on dry, gravelly ridges and sandy plains where poor soils are found. Rare on low, wet ground. Usually forms open groves of a few acres extent, scattered through forests of other species.

Range — A northern species widely distributed in southeastern Canada, Maine, west through the northern states to Minnesota, south through New England and Pennsylvania. Zones C and **D**.

Uses — An important timber species. Wood light, hard, close-grained, pale red with thin, yellowish white sapwood. Used for structural timber in bridges, boat construction, piles, etc. Red Pine is a prolific seeder and lends itself to "natural" reforestation. It is of ornamental value.



Tamarack, Larch, Hackmatack

Larix laricina (Du Roi) Koch. [Larix americana Michx.]

1. A branch with staminate flowers x 1
2. A stamen, front view x 10
3. A stamen, lateral view x 10
4. A branch with ovulate flowers x 1
5. Cover-scale, lower side x 5
6. Ovuliferous and cover-scale, upper side, showing ovules x 5
7. A fruiting branch showing mature cones x ½
8. Scale from mature cone, upper side, showing seeds x 2
9. Winged seed x 5
10. A winter twig x ½

PINACEAE

Larix laricina (Du Roi) Koch. [Larix americana Michx.]

Tamarack, Larch, Hackmatack

Habit — A tree of medium stature, under optimum conditions sometimes 50–110 feet in height, with a trunk diameter of 2–3 feet, usually much smaller, shrubby near the northern limit of its range. Crown in young trees narrowly pyramidal, often extending to the ground, in older trees in abundant light, forming a broad, open head. Branches slender, slightly ascending, feathery with the foliage.

Leaves — Linear, triangular, rounded above and ridged beneath, pale green, ¾–1¼ inches in length, deciduous in the autumn of the first year. On the growth of the season they occur singly in spirals, on the older growth in clusters terminating short lateral spurs.

Flowers — Appearing in May and June with the leaves, monoecious, borne in cones. Staminate cones arise laterally along the 1–2-year twigs, subglobose, sessile, about ¼ of an inch long, yellow at maturity. Ovulate cones lateral on 1–3-year twigs, scattered, oblong, about ¼ of an inch long, short-stalked, consisting of rose-colored bracts with green tips subtending rose-red fertile scales.

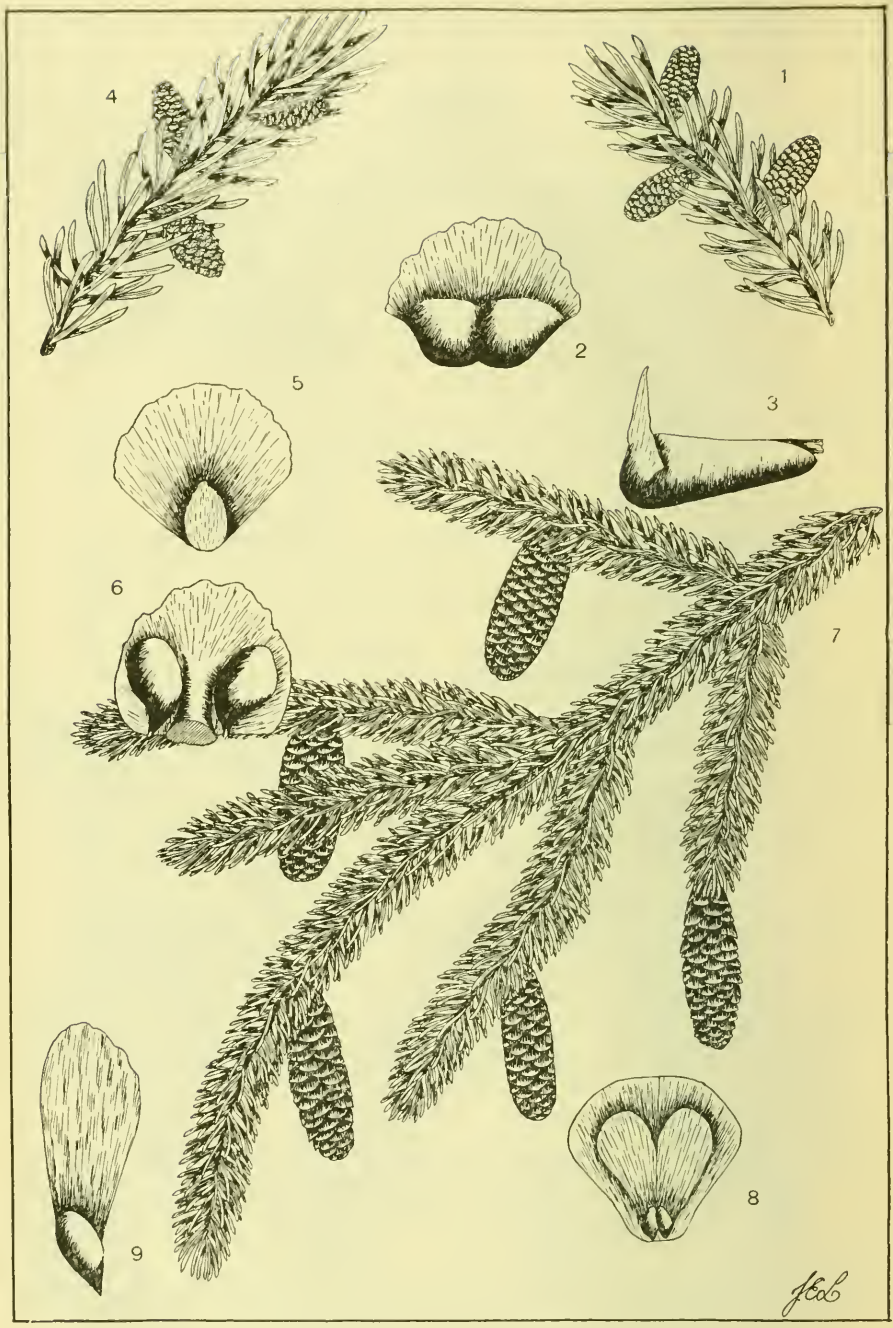
Fruit — An oblong, obtuse, chestnut-brown cone, ½–¾ of an inch long, borne on a stout, short, incurved stalk, attaining full size in the autumn of the first year and setting free its seeds during the fall and winter. Opened cones turn darker with age and persist on the twigs for a season or two. Cone-scales about 20 in number, strongly concave and semi-orbicular, usually with erose margins. Seeds light brown, winged, about ⅛ of an inch long.

Winter characters — Terminal branchlets light orange-brown with small, lustrous, globose, red buds. Two and three-year branches darker, with short lateral spurs. Mature bark thin, close, separating at the surface into thin, reddish brown scales.

Habitat — In the southern part of its range, mostly confined to cold, springy swamps, further northward inhabiting well-drained uplands and hillsides. Extending to the limit of tree growth beyond the Arctic Circle and becoming greatly dwarfed.

Range — Newfoundland west to Alaska and British Columbia, south through the northern states to northern Pennsylvania, West Virginia, northern Indiana and Illinois, Wisconsin and central Minnesota. A transcontinental species. Zones B, C, **D**, and E.

Uses — Wood hard, heavy, strong, coarse-grained, light brown with thin, nearly white sapwood, very durable in contact with the soil. Used largely "hewn" for fence posts, telegraph and telephone poles, railroad ties, etc. The tree is grown for ornament and is especially adapted, though not restricted, to moist sites.



White Spruce, Cat Spruce

Picea canadensis (Mill.) B. S. and P. [Picea alba (Ait.) Link]

1. A branch with staminate flowers x 1
2. A stamen, front view x 10
3. A stamen, lateral view x 10
4. A branch with ovulate flowers x 1
5. Cover and ovuliferous scale, lower side x 8
6. Ovuliferous-scale, upper side, showing ovules x 8
7. A fruiting branch showing mature cones x ½
8. Scale from mature cone, upper side, showing seeds x 2
9. Winged seed x 4

PINACEAE

Picea canadensis (Mill.) B. S. and P. [Picea alba (Ait.) Link, Picea glauca Voss.]

White Spruce, Cat Spruce

Habit — A tree in the east attaining a height of 60–70 feet at maturity, with a trunk diameter of 1–2 feet, in the western part of its range sometimes becoming 150 feet in height. Crown irregularly and openly pyramidal, obtuse at the apex, consisting of long, rather stout, upcurving branches which are densely clothed with pendant laterals.

Leaves — Borne on sterigmata in dense spirals, those on the under side curving upward and causing the foliage to appear crowded on the upper side of the twigs, awl-shaped, 4-sided, acute to acuminate at the apex, glaucous green when young, becoming dark bluish-green, ½–¾ of an inch long, falling gradually after 7–10 years.

Flowers — Appearing in May and early June, monoecious, borne in cones. Staminate cones terminal or subterminal, borne on stalks nearly ½ of an inch long, ½–¾ of an inch long, reddish yellow at maturity. Ovulate cones terminal or subterminal, borne on different branches, oblong-cylindrical, ½–¾ of an inch long, reddish or yellowish green at pollination.

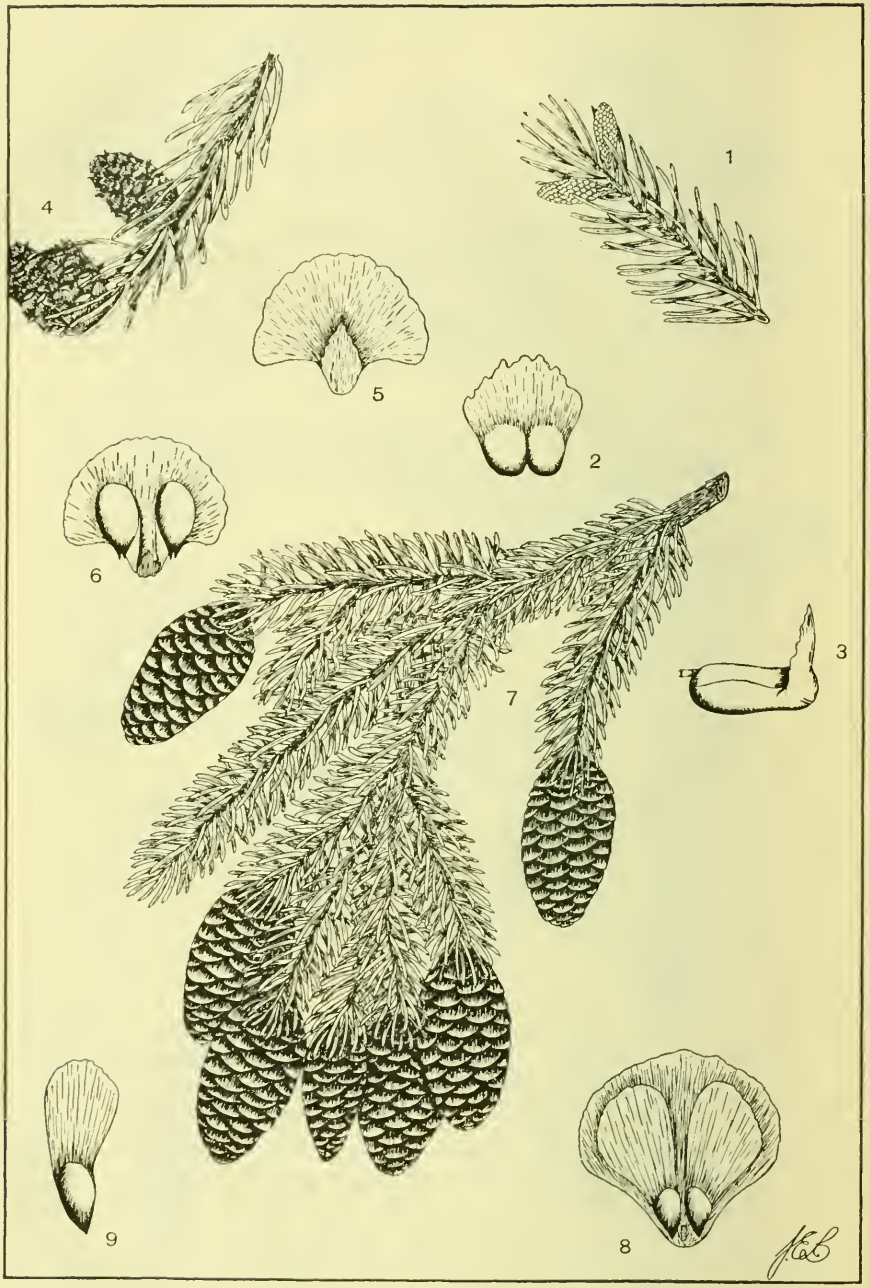
Fruit — An oblong-cylindric, nearly sessile, green cone, ½–2½ inches in length, attaining full size by the middle of the summer, at maturity turning pale brown and shining, falling during the autumn soon after the seeds are set free. Cone-scales rounded, pale brown, with nearly entire margin. Seeds brown, winged, about ⅛ of an inch long.

Winter characters — Branchlets stout, orange-brown during the first autumn and winter, at length dark grayish brown. Buds ⅛–¼ of an inch in length, broadly ovate, blunt, with light chestnut, ciliate scales, rounded at the apex. Mature bark gray, tinged with brown, thin, separating into thin, plate-like scales.

Habitat — Typically found on low, moist, alluvial soils along the banks of streams, shores of lakes and ponds, and the borders of swamps. In the northeast occurring along the sea-cliffs where it is continually bathed with salt spray. Extending in the far north, in company with Tamarack and Black Spruce, to the limit of tree growth beyond the Arctic Circle.

Range — Labrador and Newfoundland to Alaska, south through Canada into New England, northern New York, Michigan, Wisconsin, Minnesota, the Dakotas and northern Montana. A transcontinental species. Zones C, D, and **E**.

Uses — An important timber tree within its optimum range. Wood light, soft, fine-grained, weak, light yellow with scarcely distinguishable sapwood. Usually not separated in the trade from that of Red Spruce and used for similar purposes. The principal source of wood pulp at the present time.



Red Spruce

Picea rubra (Du Roi) Dietr. [Picea rubens Sarg.; Picea australis Small.]

1. A branch with staminate flowers x 1
2. A stamen, front view x 5
3. A stamen, lateral view x 5
4. A branch with ovulate flowers x 1
5. Cover and ovuliferous scale, lower side x 5
6. Ovuliferous-scale, upper side, showing ovules x 5
7. A fruiting branch showing mature cones x ½
8. Scale from mature cone, upper side, showing seeds x 2
9. Winged seed x 2

PINACEAE

Picea rubra (Du Roi) Dietr. [Picea rubens Sarg.; Picea australis Small.]

Red Spruce

Habit — A tree at maturity attaining a height of 70–80 feet, with a trunk diameter of 2–3 feet, occasionally becoming 100 feet tall, on high mountain slopes often dwarfed and shrubby. Crown, where light permits, narrowly conical, consisting of slender spreading branches reaching nearly or quite to the ground. When crowded in the forest, the crown is greatly reduced in size (sometimes to a mere tip), leaving the bole clean for two-thirds of its length.

Leaves — Borne on sterigmata in close spirals, standing out from all sides of the branches, ascending, awl-shaped, 4-sided, blunt or acute at the apex, curved inward above the middle, yellowish green and lustrous at maturity, ½–⅝ of an inch long, falling gradually after the sixth year.

Flowers — Appearing in April and May, monoecious, borne in cones. Staminate cones terminal or subterminal, short-stalked, about ½ of an inch long, oval, bright red at maturity. Ovulate cones terminal or subterminal, on different branches, oblong-cylindrical, about ¾ of an inch in length, reddish green at pollination.

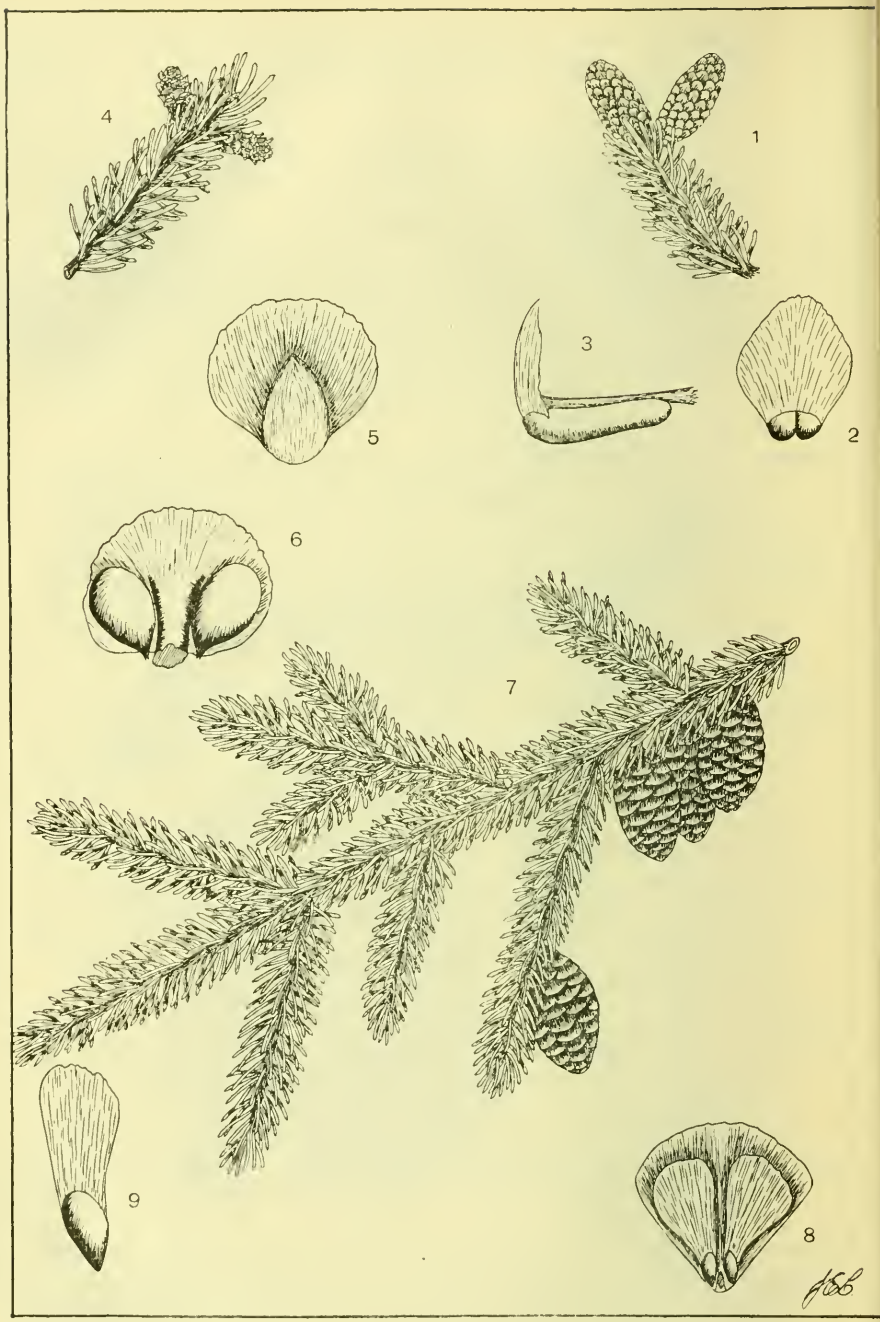
Fruit — An ovate-oblong, purplish, light green cone, 1–2½ inches in length, borne on short, usually straight peduncles, attaining full size by the middle of the summer, turning light reddish brown and shining at maturity, opening and beginning to fall in the late autumn, a few persisting until the following summer. Cone-scales rounded, reddish brown, with entire margin. Seeds dark brown, winged, about ⅛ of an inch long.

Winter characters — Branchlets rather stout, light reddish or orange-brown, covered with rusty-brown hairs, becoming dark brown and smooth the second season. Three- and four-year branches scaly. Buds ¼–⅓ of an inch in length, ovate, acute, with closely appressed, acute scales. Mature bark reddish brown, thin, flaking off in thin scales.

Habitat — Attaining its best development on well-drained uplands, tablelands, and mountain slopes, often in admixture with Yellow Birch, Beech, and Maple, likewise invading swamps in company with Black Spruce and Tamarack. The common spruce of the Adirondacks. Thrives well on thin soils.

Range — Newfoundland southwest through the elevated portions of New England and New York, thence along the Alleghanies to Georgia. Zones C, **D**, and **E**.

Uses — An important timber tree, ranking second only to White Pine in the state as a timber-producing species and, due to the exhausted supply of the last, the most important timber tree of the forests of the northeastern states. Wood light, soft, even-grained, reddish yellow with nearly white sapwood, resonant. Largely manufactured into lumber and used for a variety of purposes where a soft, easily workable wood is required. The best wood for the sounding boards of musical instruments because of its resonant qualities. An important source of chemical wood pulp.



Black Spruce

Picea mariana (Mill.) B. S. and P. [Picea nigra (Ait.) Link.]

1. A branch with staminate flowers x ½
2. A stamen, front view x 10
3. A stamen, lateral view x 10
4. A branch with ovulate flowers x ½
5. Cover and ovuliferous scale, lower side x 8
6. Ovuliferous-scale, upper side, showing ovules x 8
7. A fruiting branch showing mature cones x ½
8. Scale from mature cone, upper side, showing seeds x 2
9. Winged seed x 4

PINACEAE

Picea mariana (Mill.) B. S. and P. [Picea nigra (Ait.) Link.]

Black Spruce

Habit — Usually a small tree 10–30 feet in height with a trunk diameter of 4–12 inches, occasionally at its optimum range reaching a height of 100 feet. An extremely variable form. Crown narrowly pyramidal, irregular and open, in exposed trees often extending to the ground. Branches short, declined but curving upward at the ends, the basal ones frequently taking root and sending up shoots (layering).

Leaves — Borne on sterigmata in close spirals, standing out from all sides of the branches, awl-shaped, 4-sided, blunt at the apex, straight or slightly curved, bluish green, ¼–¾ of an inch long, falling gradually after 7–10 years.

Flowers — Appearing in May and early June, monoecious, borne in cones. Staminate cones terminal or subterminal, almost sessile, about ⅛ of an inch long, cylindrical to subglobose, dark red at maturity. Ovulate cones terminal or subterminal, on different branches, oblong-cylindrical about ⅛ of an inch long, purple at pollination.

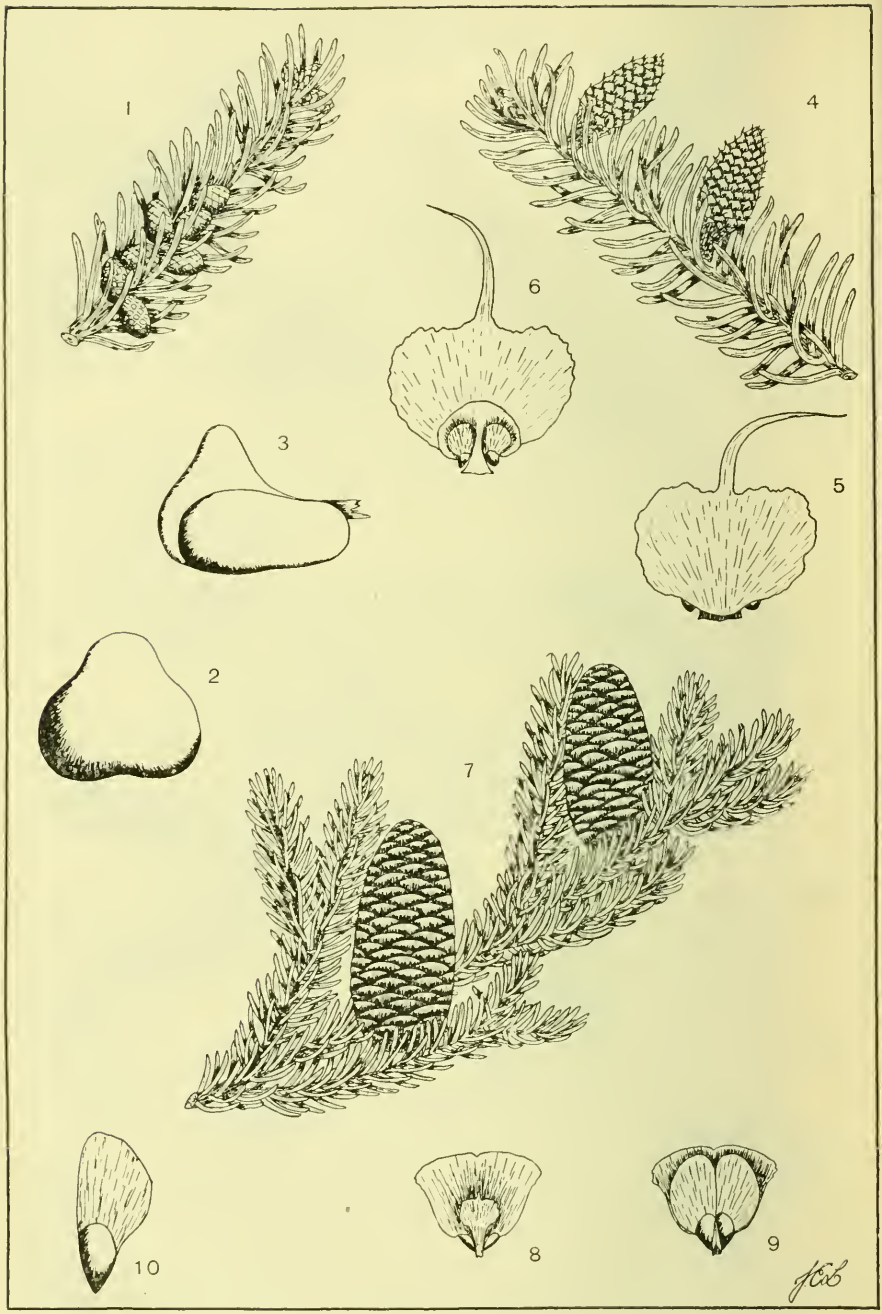
Fruit — An ovate, purplish brown cone, ½–1½ inches in length, borne on short incurved peduncles, strongly reflexed, attaining full size early in the summer, turning grayish brown and opening gradually in the autumn but remaining on the trees many years. Cone-scales rounded, dull grayish brown, with erose margins. Seeds dark brown, winged, about ⅛ of an inch long.

Winter characters — Branchlets at first light or yellowish brown and covered with short rusty hairs, during the second year becoming dark brown, glabrous, and scaly. Buds ⅛–¼ of an inch long, ovate, acute, puberulent, light reddish brown, with closely appressed scales. Mature bark grayish brown, thin, flaky, with appressed scales.

Habitat — Typically found in sphagnum bogs and cold, springy swamps, more rarely on drier, better-drained uplands and rocky slopes. In company with Tamarack, extending northward to the limit of tree growth where specimens two or three feet in height are found bearing cones.

Range — A transcontinental species extending from Labrador to Alaska, south through New England and New York to Pennsylvania, northern Virginia, Michigan, Wisconsin and central Minnesota. Zones C, **D**, and E.

Uses — Rarely sawed into timber in the state because of its small stature. Wood light, soft, weak, pale yellowish white with thin sapwood. Used largely in the manufacture of chemical pulp. Varieties of the Black Spruce (as the Hudson Bay form) are used ornamentally. Often cut for Christmas trees.



Balsam Fir, Balsam

Abies balsamea (L.) Mill.

1. A branch with staminate flowers x 1
2. A stamen, front view x 10
3. A stamen, lateral view x 10
4. A branch with ovulate flowers x 1
5. Cover-scale, lower side x 15
6. Cover- and ovuliferous-scale, upper side, showing ovules x 15
7. A fruiting branch showing mature cones x ½
8. Scale and subtending bract from mature cone, lower side x 1
9. Scale from mature cone, upper side, showing seeds x 1
10. Winged seed x 1½

PINACEAE

Abies balsamea (L.) Mill.

Balsam Fir, Balsam

Habit — A tree usually 40–60 feet in height with a trunk diameter of 1–1½ feet, under optimum conditions sometimes attaining a height of 80 feet. In young trees growing in the open, the crown is pyramidal, open and broad-based, consisting of slender, elongated, horizontal branches in rather distant whorls of 4–5, the lower sometimes slightly pendulous. Under crowded forest conditions the lower branches subsequently die, leaving a reduced spire-like crown.

Leaves — Borne spirally, those on the young growth or sterile branches appearing 2-ranked, spreading at right angles to the twig, those near the top of the crown incurved, almost erect, entirely clothing the branches on the upper side, stalkless, oblong-linear, flat, generally blunt, entire margined, dark green and shining above, with 2 broad, white-glaucous lines beneath, each consisting of about 6 rows of stomata, ½–1¼ inches long, about 1/16 of an inch wide.

Flowers — Appearing in May, monoecious, borne in cones. Staminate cones borne on the growth of the preceding season from axillary buds, clothed at the base by persisting bud-scales, oval to oblong-cylindrical, yellow at maturity tinged with reddish purple. Ovulate cones borne similarly but confined to the upper side of the topmost branches, erect, oblong-cylindrical, about 1 inch long, consisting of purple bracts with green, caudate tips.

Fruit — An erect, oblong-cylindrical, puberulous, dark purple cone, 2½–4 inches long, rounded at the apex, usually bearing globules of resin, maturing in the autumn of the first year. Cone-scales usually slightly longer than broad, thin, fan-shaped, longer than the bracts, deciduous from the upright cone-axis. Seeds winged, about ¼ of an inch long, equipped with resin vesicles.

Winter characters — Branchlets slender, usually borne opposite, pubescent, at first yellowish green, becoming at length grayish brown tinged with purple, smooth and somewhat lustrous. Buds about 1/5 of an inch long, clustered at the ends of the twigs, globose to ovate, covered with a resinous exudation, with dark orange-green, lustrous bud-scales. Bark on young branches pale gray, thin, smooth, marked by raised areas denoting the presence of resin cysts. Mature bark pale reddish brown, separating into small, irregular, scaly plates.

Habitat — Thrives best on moist sites in swamps and peat bogs, or on mountain tops and slopes where condensation offers sufficient moisture. A common tree of the Adirondacks in low situations associated with Red and Black Spruce, Tamarack, and Hemlock.

Range — Labrador west to Athabasca and Alberta, south into the states from Maine to Minnesota, and along the mountains to Virginia. Zones D and **E.**

Uses — Of little value as a source of lumber. Wood light, soft (of cheesey consistency when green), coarse-grained, not durable, pale brown tinged with yellow, with thick, lighter sapwood. Used with more valuable species in the manufacture of pulp. Balsam is occasionally used ornamentally and as a Christmas tree. The Canada balsam of commerce is derived from this tree.

Hemlock

Tsuga canadensis (L.) Carr.

1. A branch with staminate flowers x 1
2. A stamen, front view x 20
3. A stamen, lateral view x 20
4. A branch with ovulate flowers x 1
5. Ovuliferous and cover-scale, lower side x 10
6. Ovuliferous-scale, upper side, showing ovules x 10
7. A fruiting branch showing mature cones x ½
8. Scale from mature cone, upper side, showing seeds x 2
9. Scale from mature cone, lower side x 2
10. Winged seed x 2

PINACEAE

Tsuga canadensis (L.) Carr.

Hemlock

Habit — A tree at maturity usually 60–70 feet tall with a trunk diameter of 2–4 feet, under optimum conditions becoming 100 feet in height. With sufficient light the crown is obtusely pyramidal, broad-based, consisting of horizontal branches (the lower pendulous) which extend to the ground. Under forest conditions, the trunk is often devoid of branches for two-thirds of its length and exhibits decided taper. Branches and foliage arranged in flat-topped sprays.

Leaves — Borne spirally on the branches but appearing two-ranked due to a twist in the petioles, oblong-linear, flat, obscurely grooved, rounded or notched at the apex, often obscurely denticulate, dark yellowish-green and lustrous above, with two broad, white-glaucous lines beneath, each line consisting of 5–6 rows of stomata, ½–⅔ of an inch long, about 1/16 of an inch wide.

Flowers — Appearing in May, monoecious, borne in cones. Staminate cones borne near the ends of the branches on the growth of the previous season, axillary, on slender stalks, about ⅜ of an inch long, subglobose, yellow at maturity. Ovulate cones terminal, oblong, about ⅛ of an inch long, pale green at pollination.

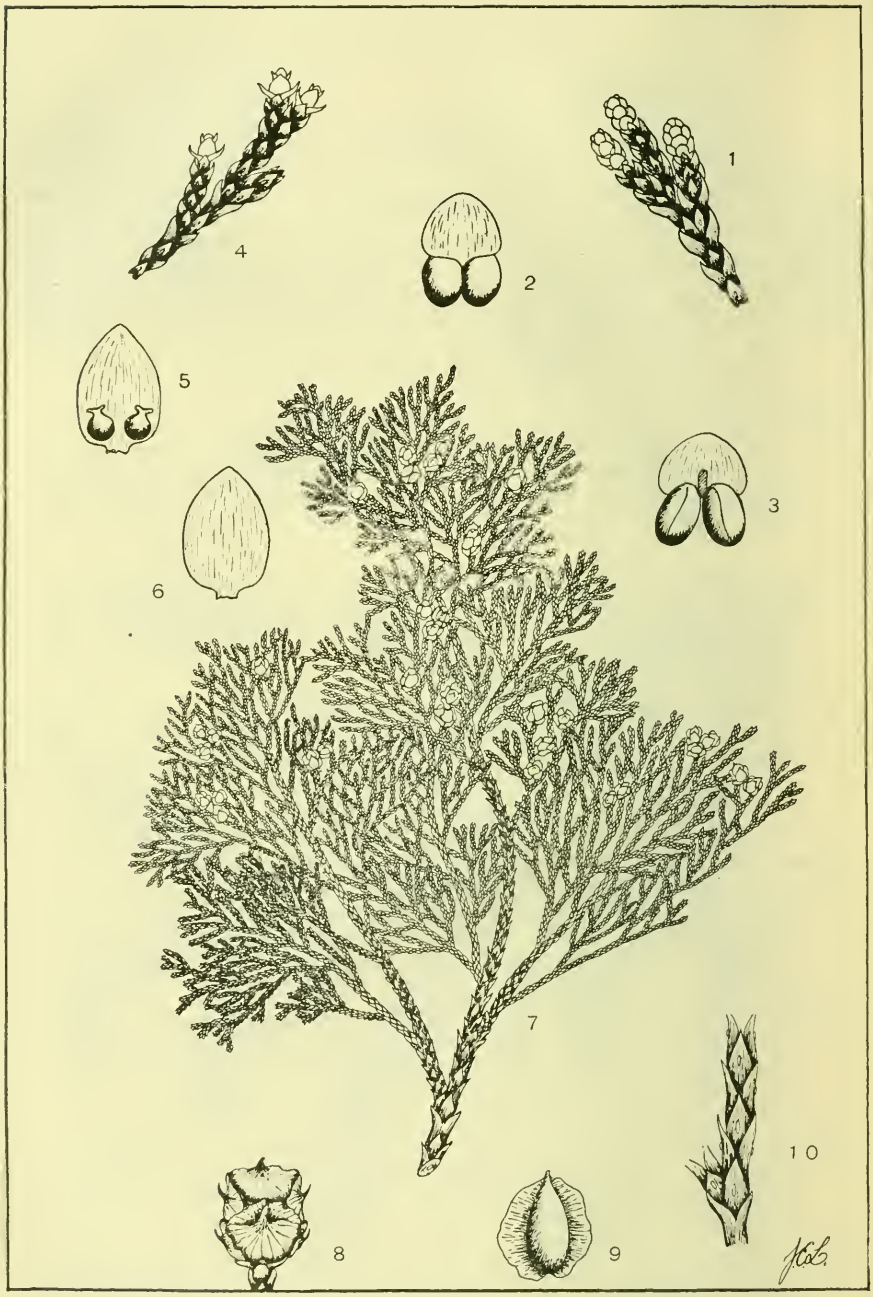
Fruit — An ovate-oblong, pale green cone, ½–¾ of an inch long, suspended on a slender, puberulous peduncle, attaining full size in the summer and turning reddish or grayish brown in the autumn, gradually setting free the seeds during the winter and falling in the spring of the second year. Cone-scales orbicular to obovate, slightly thickened above. Seeds light brown, winged, about 1/16 of an inch long.

Winter characters — Branchlets during the first winter yellowish brown and pubescent, becoming dark grayish or purplish brown and glabrous the third season. Buds about 1/16 of an inch in length, ovate, obtuse, slightly puberulous, light chestnut-brown. Mature bark reddish or grayish brown, thick, deeply divided by long fissures into broad ridges, closely scaly on the surface.

Habitat — A moisture-loving tree, occurring on damp soils along stream courses, the sides of glens, northern slopes, borders of lakes and ponds and margins of swamps. Reaches its best development under dense forest conditions where it is protected from extreme wind pressure. Shallow-rooted and subject to wind fall.

Range — Nova Scotia west through Ontario, Michigan and Wisconsin to Minnesota, south along the Appalachians to Georgia and Alabama. Attains its best development in the southern Appalachians. Zones B, C, and D.

Uses — Formerly despised as a source of timber. With the depletion in the supply of the more valuable species, the Hemlock has come to be an important timber tree. Wood light, hard, brash, coarse-grained, splintery, subject to shake, light brown, tinged with red. Chiefly manufactured into lumber of the coarser grades. The wood is also widely used for "mechanical" pulp. Hemlock bark is an important source of tannin in the northeastern states.



White Cedar, Coast White Cedar

Chamaecyparis thyoides (L.) B. S. and P. [Chamaecyparis sphaeroidea Spach.; Cupressus thyoides L.]

1. A branch-tip with staminate flowers x 2
2. A stamen, front view x 8
3. A stamen, axile view x 8
4. A branch-tip with ovulate flowers x 2
5. Ovulate cone-scale, axile side, showing ovules x 15
6. Ovulate cone-scale, distal side x 15
7. A fruiting spray showing mature cones x ½
8. Mature cone x 2
9. Winged seed x 5
10. Portion of twig showing phyllotaxy x 2½

PINACEAE

Chamaecyparis thyoides (L.) B. S. and P. [Chamaecyparis sphaeroidea Spach.; Cupressus thyoides L.]

White Cedar, Coast White Cedar

Habit — Usually a small tree from 20–50 feet in height with a trunk diameter of ½ foot, under favorable conditions sometimes attaining a height of 80–90 feet. Crown narrowly conical, consisting of slender horizontal branches with deciduous laterals, the latter commonly arranged in fan-shaped sprays.

Leaves — Opposite, keeled, often glandular, dark blue-green, dull. On normal twigs they are ovate, acuminate, appressed, imbricated, glandular, 1/16–⅛ of an inch long. The thrifty shoots have spreading, awl-shaped, often remote and eglandular leaves, usually about ⅛ of an inch long.

Flowers — Appearing in March and April, monoecious, borne in cones on different sprays. Staminate cones terminal, solitary, about ⅛ of an inch long, oblong, 4-sided, consisting of 4–6 pairs of stamens with yellow pollen sacs. Ovulate flowers terminal, usually solitary, 1/16–⅛ of an inch long, subglobose, consisting of 6 peltate spreading scales, liver-colored at pollination.

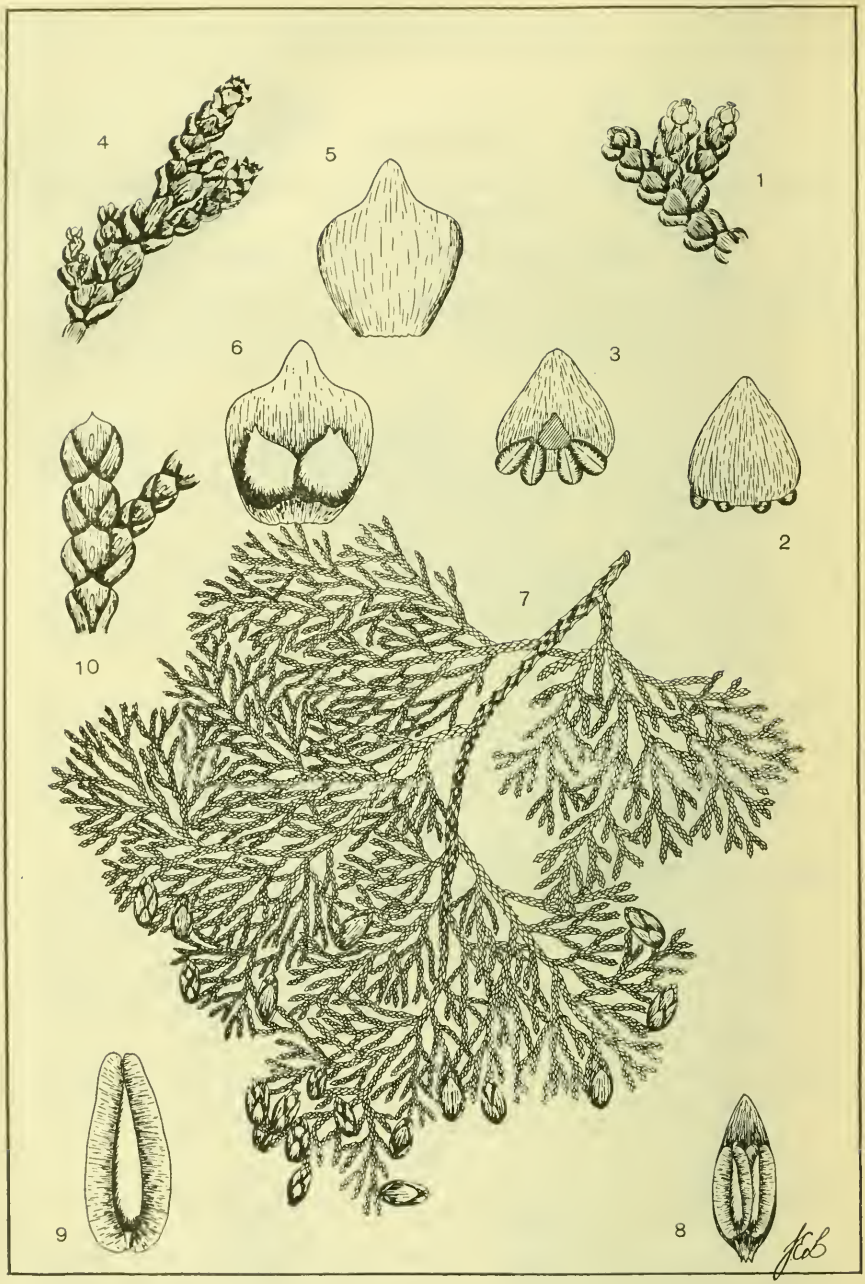
Fruit — A globose, glaucous, nearly sessile, inconspicuous, bluish purple cone, about ¼ of an inch in diameter, turning dark reddish brown at the end of the first season, opening in the autumn and persisting on the sprays. Cone-scales peltate, the outer face marked by a slight projection. Seeds grayish brown, about ⅛ of an inch long, with a dark brown wing as broad as the body.

Winter characters — Branchlets arranged in fan-shaped sprays which diverge at various angles, at first bluish green from the decussate imbricated leaves, during the first winter becoming reddish brown, at length dark brown, slowly losing their leaves and marked by the scars of the deciduous laterals, with small papery scales. Buds minute, without scales, protected by the appressed scale-like leaves. Mature bark light reddish brown, ¾–1 inch thick, fibrous consisting of narrow anastomosing ridges separated by shallow fissures.

Habitat — Thrives along the Atlantic and Gulf seaboards in cold, wet swamps which are inundated for long periods each year, in the north forming pure stands, farther south intermingled with Bald Cypress. Rarely far from the coast.

Range — Southern Maine, southward to northern Florida, westward along the Gulf Coast into Mississippi. Zone A.

Uses — An important timber tree, especially in that it thrives in regions unsuitable for other species. Wood light soft, weak, rather close-grained, slightly fragrant, light reddish brown with thin pale sapwood. Very durable in contact with the soil. Used for fence posts, poles, shingles, railroad ties, etc. The Coast White Cedar is one of the most beautiful of the eastern conifers and is grown extensively for ornament. There are numerous horticultural forms.



Arbor Vitae, White Cedar

Thuja occidentalis L.

1. A branch-tip with staminate flowers x 2
2. A stamen, front view x 10
3. A stamen, axile view x 10
4. A branch tip with ovulate flowers x 2
5. Ovulate cone-scale, distal side x 10
6. Ovulate cone-scale, axile side, showing ovules x 10
7. A fruiting spray showing mature cones x ½
8. Scale from mature cone, axile side, showing seeds x 2
9. Winged seed x 8
10. Sterile branch-tip showing decussate, glandular leaves x 2½

PINACEAE

Thuja occidentalis L.

Arbor Vitae, White Cedar

Habit — A tree at maturity attaining a height of 30–50 feet with a trunk diameter of 1–2 feet, under optimum conditions sometimes becoming 70 feet tall. Crown dense, pyramidal, rather wide-based, often extending nearly to the ground. Trunk usually short, often lobed and buttressed, sometimes twisted, commonly dividing into several upright secondary stems. Lateral branches short, horizontal, often declined, with short pendulous laterals arranged in a horizontal plane. The laterals at length die and are cast off with the leaves.

Leaves — Opposite, yellowish green; on the thrifty shoots they are scale-like, closely imbricated, ovate to lanceolate, pointed at the apex, glandular on the back, aromatic when crushed, ⅛–¼ of an inch long; on the deciduous laterals they are much smaller, of two kinds in alternating pairs, those on the side of the twig strongly keeled, those on the face flat and usually glandular, giving the twigs a flattened appearance.

Flowers — Appearing in April and May, monoecious, borne in cones on different branches. Staminate cones terminal, solitary, about 1/16 of an inch long, ovoid to globose, consisting of 4–6 stamens, yellow at maturity. Ovulate cones terminal, solitary, similar in size, ovoid, consisting of 4–6 pairs of thin scales, pinkish at pollination. Ovules borne in pairs.

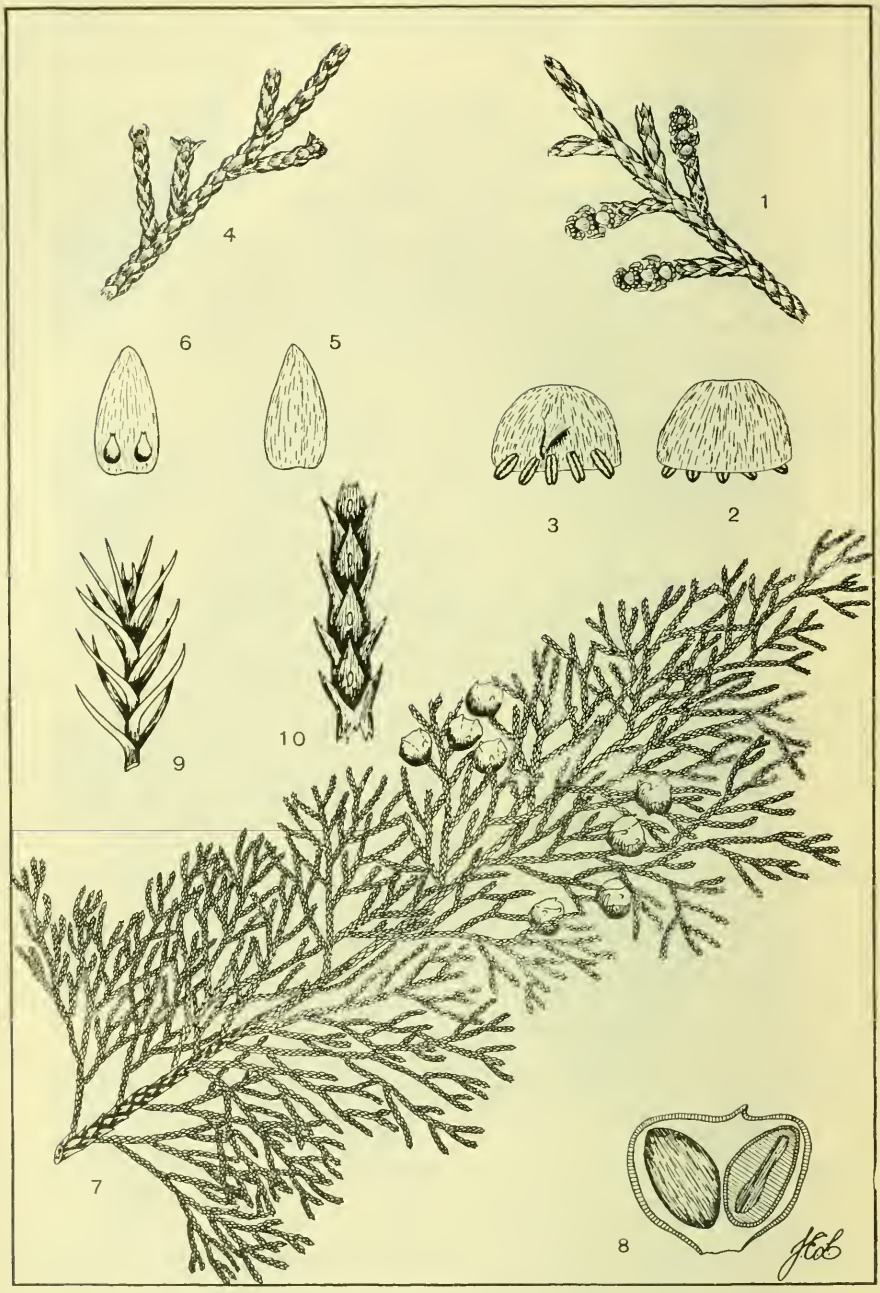
Fruit — An oblong, erect, green cone, ⅛–½ of an inch long, consisting of 6–12 obtuse scales, attaining full size by the middle of the summer, turning pale cinnamon-brown and opening in the autumn, persisting during the following winter. Cone-scales thin, dull, coriaceous, oblong, blunt-pointed, the outer usually sterile. Seeds light brown, about ⅛ of an inch long, nearly encircled by the broad wing.

Winter characters — Branchlets arranged in flat, fan-shaped sprays, yellowish green, flattened, at first completely covered by the decussate, overlapping leaves. During the second season, the laterals turn brown and fall with the leaves. The bark of the primary branches eventually becomes dark orange-brown and is marked by lateral branch-scars. Buds minute, without scales, protected by the appressed scale-like leaves. Mature bark light reddish brown, thin, fibrous, consisting of narrow anastomosing ridges separated by shallow fissures.

Habitat — Prefers low swampy sites such as stream sources, borders of ponds, streams and lakes, where it often forms almost impenetrable, pure stands or grows in company with Spruce and Balsam. Found on higher ground in the southern part of its range. Thrives on limestone outcroppings.

Range — Nova Scotia westward to Manitoba in Canada, in the United States from Maine through the border states to Minnesota, south in the mountains to Georgia and Tennessee. Zones A, B, C, and D.

Uses — Wood light, soft, brittle, aromatic, coarse-grained, light yellowish brown, darkening with exposure, with thin, nearly white sapwood. Extremely durable in contact with the soil. Largely utilized for fence posts, poles, and shingles. Arbor vitae is widely used as a hedge plant and otherwise ornamentally where varieties of abnormal habit have been developed.



Red Cedar, Pencil Cedar

Juniperus virginiana L.

1. A branch-tip with staminate flowers x 1½
2. A stamen, front view x 10
3. A stamen, axile view x 10
4. A branch-tip with ovulate flowers x 1½
5. Ovulate cone-scale, distal side x 10
6. Ovulate cone-scale, axile side, showing ovules x 10
7. A fruiting spray showing mature berry-like cones x ½
8. Section of cone showing mature seeds x 1
9. Tip from a vigorous shoot x 2½
10. Portion of normal branch showing phyllotaxy x 2½

PINACEAE

Juniperus virginiana L.

Red Cedar, Pencil Cedar

Habit — At maturity a tree usually 20–50 feet in height with a trunk diameter of 1–2 feet, under optimum conditions sometimes attaining a height of 100 feet. Crown narrowly pyramidal, compact, deep, consisting of short, slender branches, horizontal below but ascending above, in the open often extending to the ground. In old age, the crown usually becomes broad and round-topped and more or less irregular.

Leaves — Opposite, often glaucous, persisting 3–6 years. On normal shoots they are scale-like, 4-ranked, closely imbricated, ovate, acute (rarely obtuse), usually glandular on the back, dark bluish green, about 1/16 of an inch long; on vigorous shoots they are linear-lanceolate, long-pointed, without glands, light yellowish green, ½–¾ of an inch long. The first type largely predominates.

Flowers — Appearing from February to May, dioecious (rarely monoecious), borne in cones. Staminate cones numerous, terminal, ⅛–¼ of an inch long, oblong-ovate, consisting of 10–12 stamens, yellowish at maturity. Ovulate cones solitary, terminal, about 1/16 of an inch long, ovoid, consisting of about 6 fleshy, spreading, acute, bluish scales, subtended by scale-like bracts.

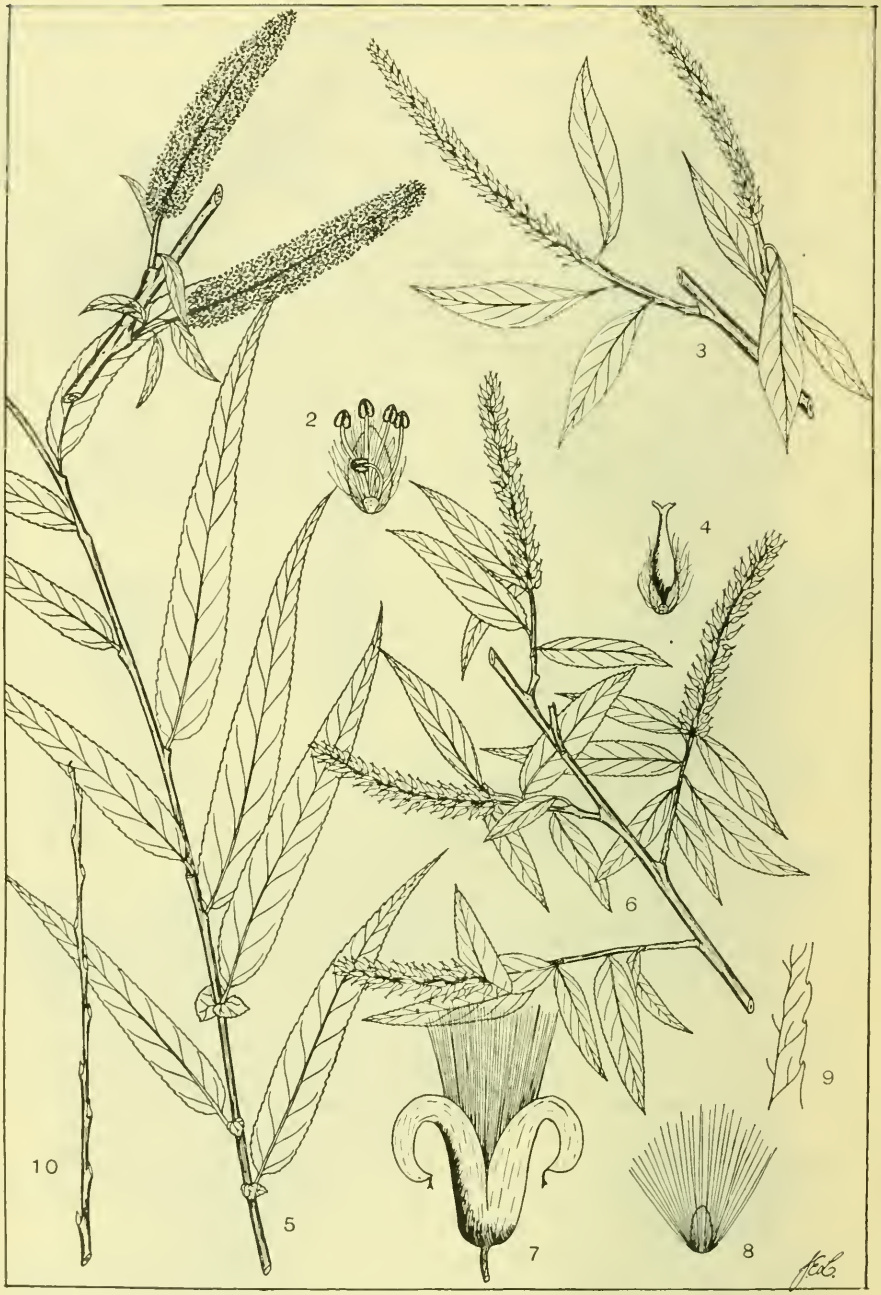
Fruit — A subglobose, pale green, somewhat angled, berry-like cone, ¼–⅓ of an inch in diameter, becoming dark blue and glaucous in the autumn, with firm epidermis and thin sweet flesh. Cone-scales fleshy, coherent. Seeds 1–2, light chestnut-brown, lustrous, wingless, 1/16–⅛ of an inch long.

Winter characters — Branchlets slender, 4-sided, at first green with the appressed leaves, at length round and dark reddish brown. Buds minute, inconspicuous, covered by the appressed, imbricated leaves. Mature bark reddish brown, thin, somewhat grooved, persisting many years, peeling off at length in long, narrow, fibrous strips.

Habitat — A gregarious species thriving on a wide variety of sites and soils including abandoned fields, rocky cliffs, limestone outcroppings, swamps, and bottom-lands. Attains its best development on the alluvial soils of the southern states.

Range — Nova Scotia west through the northern states from New England, New York and Ontario, to the Dakotas, south to Florida and Texas. Widely spread through the agency of birds. Zones A, **B**, and C.

Uses — A valuable commercial species. Wood light, soft, fragrant, brittle, extremely durable in contact with the soil, readily worked, dull red with thin, nearly white sapwood. The most important species in pencil manufacture. Largely used for moth-proof chests, cabinet-making, interior finish, fence posts, etc. The tree is likewise used extensively ornamentally.



Black Willow, Crack Willow

Salix nigra Marsh.

1. A twig showing staminate aments x ½
2. A staminate flower, axile view x 5
3. A twig showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A vigorous twig showing leaves and stipules x ½
6. A branch showing leaves and fruiting aments x ½
7. Mature capsule x 4
8. Comose seed x 4
9. Portion of leaf-margin, enlarged
10. Winter twig x ½

SALICACEAE

Salix nigra Marsh.

Black Willow, Crack Willow

Habit — The largest native willow. A tree of rapid growth, attaining maturity between 50–70 years, under optimum conditions sometimes 120 feet in height with a trunk diameter of 2–3 feet, usually much smaller, often with several crooked medium-sized trunks ascending obliquely from the same root crown. Crown broad and open, consisting of stout, ascending branches and drooping branchlets.

Leaves — Alternate, lanceolate, 3–6 inches long, ⅛–¾ of an inch wide, long attenuate and usually curved at the apex, rounded or wedge-shaped at the base, finely serrate, at maturity thin, light green, smooth and lustrous above, pale green and glabrous (except on the veins) beneath, borne on short petioles. Stipules on vigorous shoots foliacious, semi-cordate and persistent, on normal shoots minute, ovoid and deciduous.

Flowers — Appearing in May, terminal on short, lateral, leafy branchlets, dioecious, glandular, borne in the axils of yellow, rounded scales, the whole forming narrow, cylindrical aments 1–3 inches in length. Perianth wanting. Stamens 3–5, with long filaments and yellow anthers. Pistil solitary, consisting of a stalked, glabrous, ovate, 1-celled ovary and 2 nearly sessile, thick stigmas.

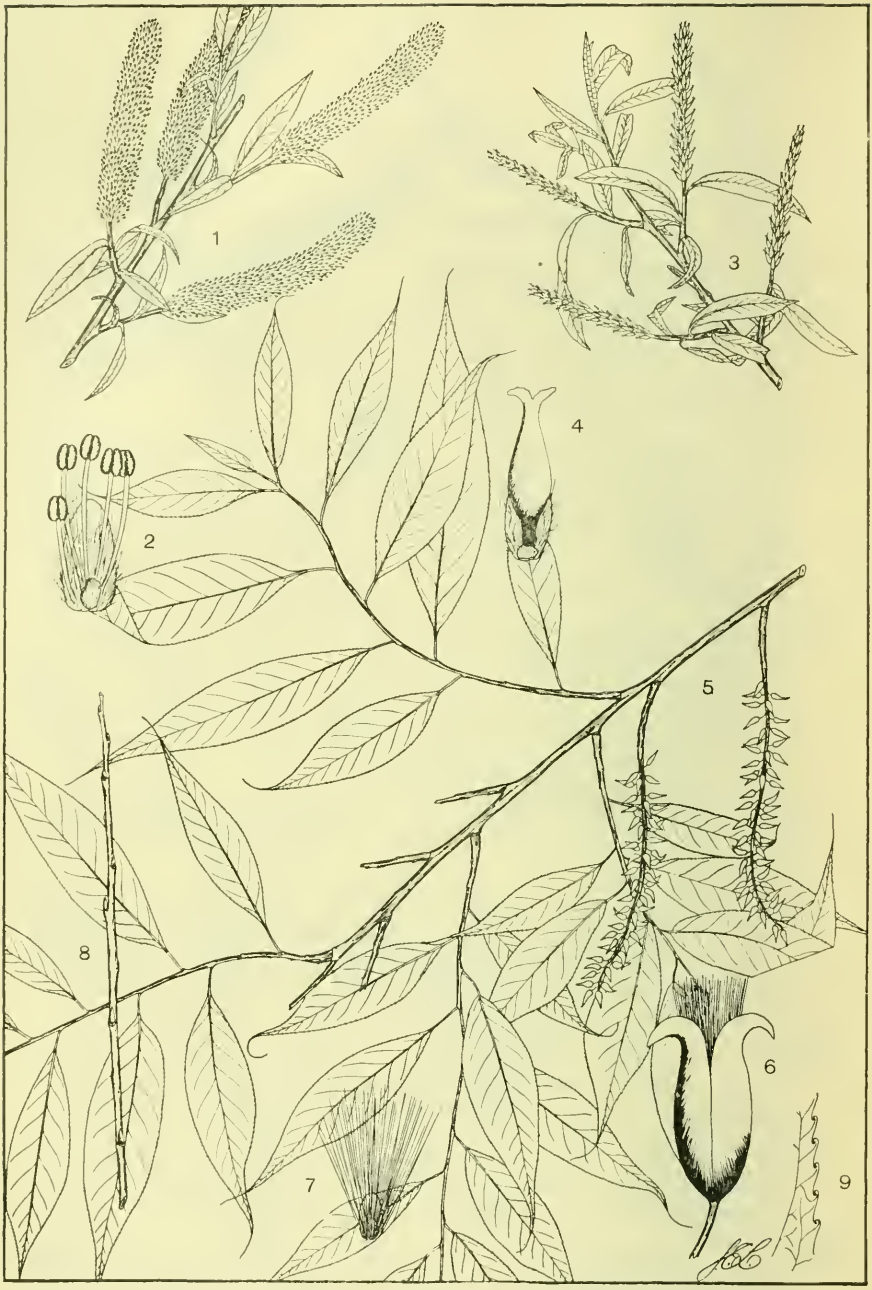
Fruit — A reddish brown, ovate, smooth, short pedicellate capsule, about ⅛ of an inch long, opening by 2 sutures at maturity to set free the minute, comose seeds.

Winter characters — Twigs slender, smooth, very brittle at the base, reddish brown to pale orange. Terminal bud lacking. Lateral buds 1-scaled, acute, reddish brown, about 1/16 of an inch long. Mature bark varying from brown to nearly black, thick, divided by deep furrows into broad, flat, anastomosing ridges, scaly at the surface.

Habitat — A moisture-loving species growing on wet sites along stream courses, shores of lakes, flat swampy areas, more rarely in upland situations. Propagates as readily through natural cuttings as through seeds.

Range — A widely distributed species ranging from New Brunswick west through southern Canada to the Dakotas, south to Florida and Texas, thence westward into central California. Zones A, **B**, **C**, and D.

Uses — Of secondary importance as a timber tree, producing a low grade of lumber. Wood light, soft, weak, fine grained, pale reddish brown with light, nearly white sapwood. Made into artificial limbs, slack cooperage, excelsior, charcoal, pulp and cheap furniture. Because of the ease of propagation by cuttings and its rapid growth, this species is used extensively in bank revetment along streams.



Peach-leaved Willow, Almond-leaved Willow

Salix amygdaloides Anders.

1. A twig showing staminate aments x ½
2. A staminate flower, axile view x 5
3. A twig showing pistillate aments x ½
4. A pistillate flower, axile view x ½
5. A branch showing mature leaves and fruiting aments x ½
6. Mature capsule x 4
7. Comose seed x 4
8. Winter twig x ½
9. Portion of leaf-margin, enlarged

SALICACEAE

Salix amygdaloides Anders.

Peach-leaved Willow, Almond-leaved Willow

Habit — A tree under optimum conditions occasionally 60–70 feet in height with a trunk diameter of 1–2 feet and a single, columnar bole, usually much smaller. Crown rather narrow, rounded, consisting of ascending, spreading branches.

Leaves — Alternate, ovate-lanceolate to lanceolate, 2½–4 inches long, ¾–1 inch wide, attenuate-cuspidate at the apex, wedge-shaped or somewhat rounded at the base, finely serrate, at maturity thin, firm, light green and lustrous above, pale glaucous below, borne on long, usually twisted petioles which diverge nearly at right angles to the twigs. Stipules minute, fugacious.

Flowers — Appearing in May with the leaves, terminal on short, lateral, leafy branchlets, dioecious, glandular, in the axils of yellow, broadly ovate scales, the whole forming an elongated, cylindrical, more or less erect, hairy ament 2–3 inches in length. Perianth wanting. Stamens 5–9, with long filaments and yellow anthers. Pistil solitary, similarly borne, consisting of an oblong-conical, glabrous, long-stalked, 1-celled ovary, a short style and 2 spreading stigmas.

Fruit — A pale, reddish yellow, globose-conical, pedicellate capsule, about ¼ of an inch long, opening by 2 sutures at maturity to set free the minute, comose seeds.

Winter characters — Twigs slender, smooth, pale lenticellate, not brittle at the base, orange or reddish brown. Terminal bud lacking. Lateral buds brown and lustrous, 1-scaled, rather blunt, ovoid, about ⅛ of an inch long. Mature bark brown, thick, irregularly furrowed and scaly ridged.

Habitat — Typically found along the banks of streams, rivers, lake shores, and on wet bottom-lands, rarely in dry gravelly and sandy soils.

Range — Western Quebec through southern Canada to British Columbia, central New York westward to Washington, southwest to Texas and New Mexico. Zones **B** and **C**.

Uses — Produces a soft, weak, close-grained, inferior wood, light brown with rather thick, white sapwood. Occasionally manufactured into cheap lumber. Used locally for fuel and charcoal.

Bay-leaved Willow, Laurel-leaved Willow

Salix pentandra L. [Salix laurifolia Hort.]

1. A twig showing staminate aments x ½
2. A staminate flower, axile view x 4
3. A twig showing pistillate aments x ½
4. A pistillate flower, axile view x 4
5. A twig with mature leaves x ½
6. A twig showing leaves and fruiting aments x ½
7. Mature capsule x 3
8. Comose seed x 3
9. Winter twig x ½

SALICACEAE

Salix pentandra L. [Salix laurifolia Hort.]

Bay-leaved Willow, Laurel-leaved Willow

Habit — A small tree, 25–40 feet high with a trunk diameter of 5–10 inches, often shrubby. Crown round-topped, symmetrical, consisting of wide-spreading branches, the lower somewhat pendulous. Bole short, stout, dividing above into several large, obliquely ascending limbs.

Leaves — Alternate, ovate, oblong-ovate or obovate, 1½–4 inches long, 4/5–2 inches wide, acute at the apex, rounded at the base, finely glandular serrate, at maturity coriaceous, dark green and very lustrous above, green and paler below, borne on short glandular petioles. Stipules broadly ovate to semi-circular, ¼–½ of an inch long, fugacious except on vigorous shoots.

Flowers — Appearing in April and May, dioecious, glandular, borne in the axils of hairy, narrowly ovate scales, the whole forming rather loosely flowered aments which are borne terminally on short leafy branchlets. Staminate aments long-cylindrical, 1–2 inches long. Pistillate aments similar. Stamens 5, with long, free, smooth filaments and small anthers. Pistil solitary, consisting of a smooth, narrowly ovoid ovary which is rounded and stalked at the base and attenuate at the apex, and 2 nearly sessile, spreading stigmas.

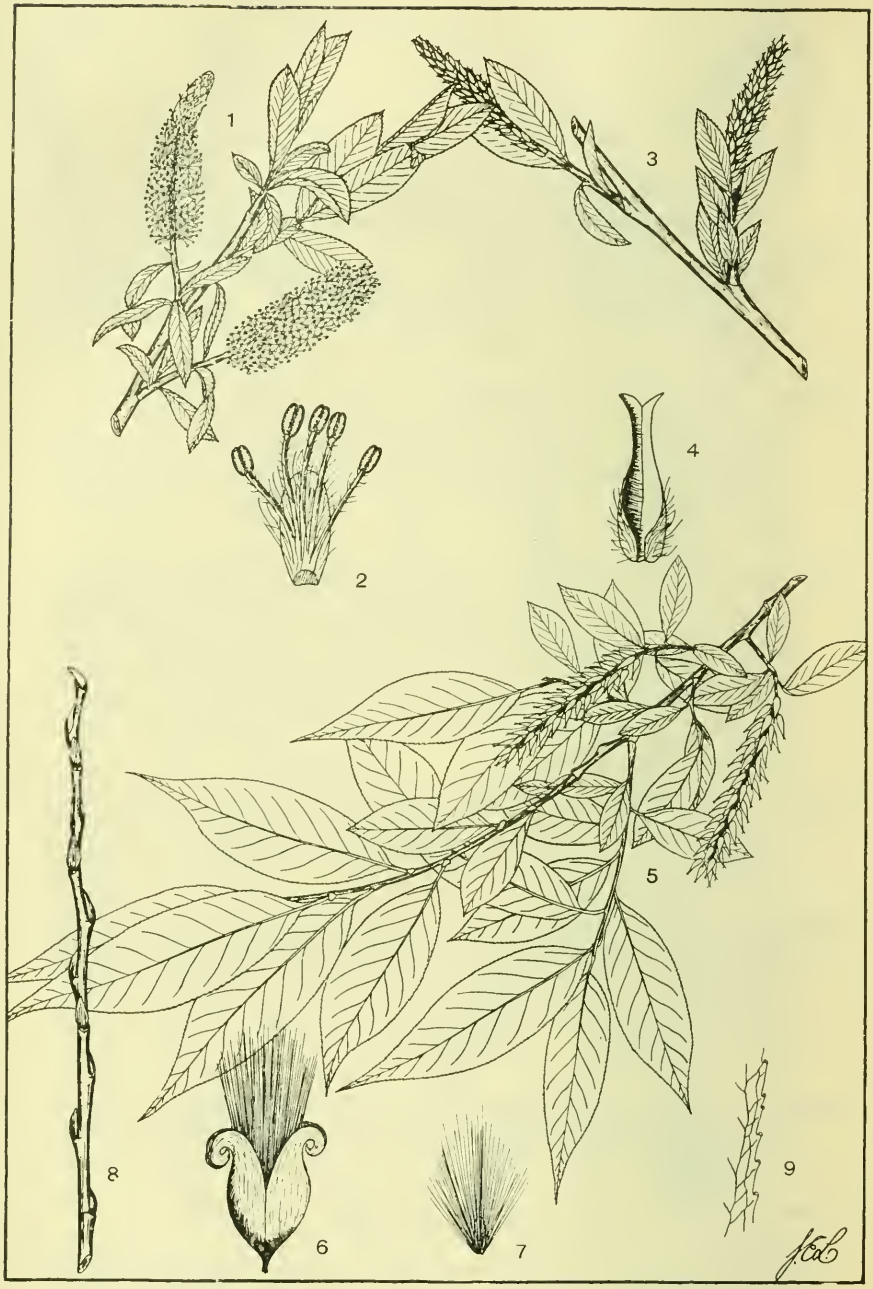
Fruit — A short pedicellate, smooth, lustrous, straw-colored or pale brown, conic-subulate capsule, rounded and somewhat cordate at the base, ⅕–⅓ of an inch long, opening by 2 opposite sutures at maturity to set free the minute, comose seeds.

Winter characters — Twigs, slender, lenticellate, terete, smooth, lustrous, greenish yellow, at length dull gray and roughened by the leaf- and branch-scars. Terminal bud lacking. Lateral buds 1-scaled, oblong-ovate, bluntly acute and smooth, greenish yellow, ¼–⅜ of an inch long. Mature bark dark brownish black, deeply fissured with narrow ridges, scaly at the surface.

Habitat — Readily propagated and not exacting as to soil requirements provided a sufficient supply of moisture is available. Thrives on gravelly or loamy, upland soils.

Range — A native of Europe and Asia, extensively cultivated but seldom escaping in this country. Zones A, B, and C.

Uses — An ornamental species largely used in parks, cemeteries, and private estates because of its dark green, lustrous, laurel-like leaves. Of no commercial significance in the United States other than the above.



Shining Willow

Salix lucida Muhl.

1. A twig showing staminate aments x 1
2. A staminate flower, axile view x 5
3. A twig showing pistillate aments x 1
4. A pistillate flower, axile view x 5
5. A twig showing mature leaves and fruiting aments x ½
6. Mature capsule x 4
7. Comose seed x 5
8. Winter twig x ½
9. Portion of leaf-margin, enlarged

SALICACEAE

Salix lucida Muhl.

Shining Willow

Habit — Usually shrubby, occasionally a small bushy tree 20–30 feet in height with a trunk diameter of 6–8 inches. Crown round-topped, symmetrical, rather broad. Trunk short.

Leaves — Alternate, lanceolate to ovate-lanceolate, 3–5 inches long, 1–1½ inches wide, attenuate at the apex, wedge-shaped or rounded at the base, finely serrate, at maturity coriaceous, dark green and lustrous above, paler and lustrous beneath, borne on short, terete, glandular petioles. Stipules semi-circular, membranous, persistent through the summer.

Flowers — Appearing in May and early June, dioecious, glandular, borne in the axils of yellowish, rounded scales, the whole forming aments terminating short leafy branches. Staminate aments oblong-cylindrical, densely flowered, 1–1½ inches long. Pistillate aments slender-cylindrical, 1½–2 inches long. Perianth wanting. Stamens 5, with long filaments which are hoary below, and yellow anthers. Pistil solitary, consisting of a stalked, glabrous, conic-ovoid ovary and 2 nearly sessile stigmas.

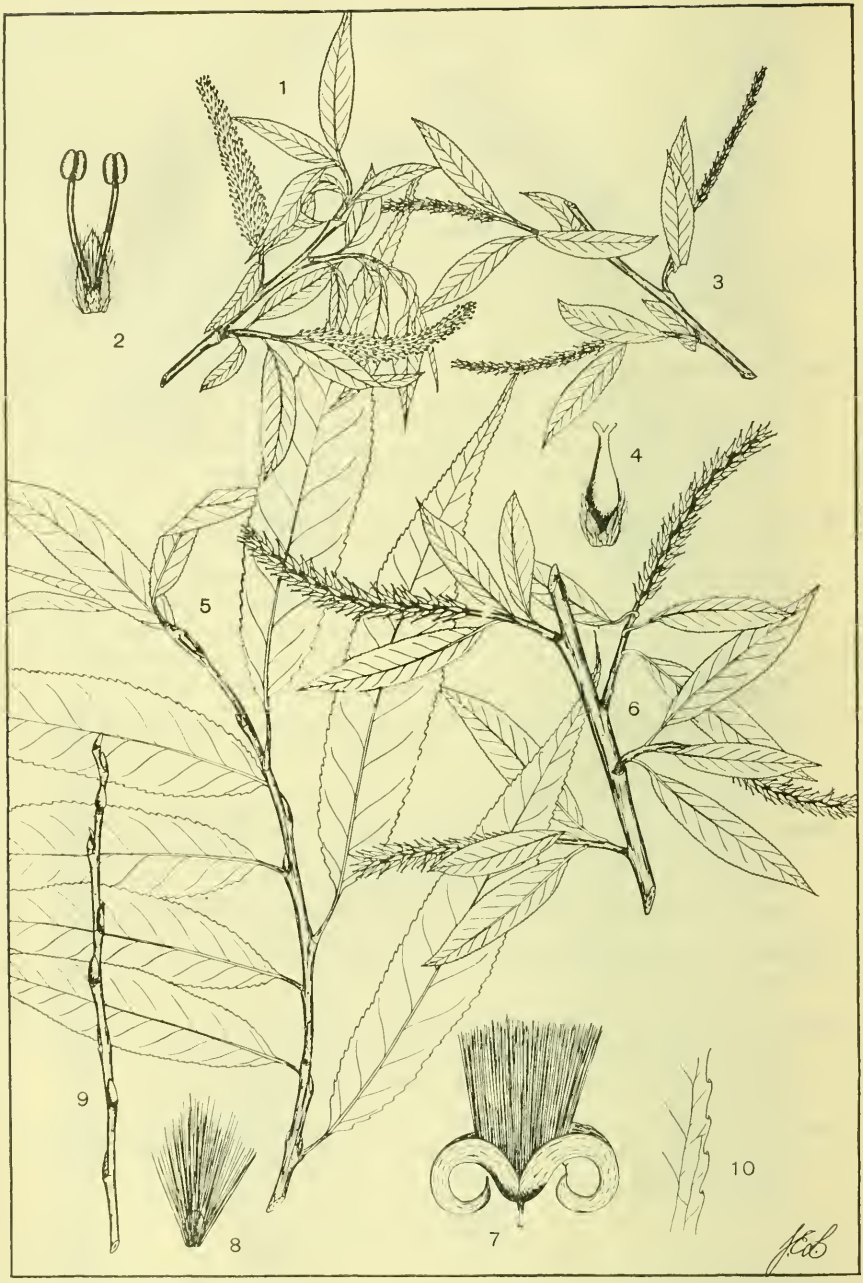
Fruit — A pale brown, smooth and lustrous, conic-ovoid capsule, about ⅓ of an inch long, opening by 2 opposite sutures at maturity to set free the minute, comose seeds.

Winter characters — Twigs stout, glabrous, dark yellowish brown, at length dark brown. Terminal bud lacking. Lateral buds 1-scaled, oval, acute, yellowish brown and lustrous, about ¼ of an inch long. Mature bark reddish brown, thin, divided into furrows and flat-topped, shallow ridges.

Habitat — A moisture-loving species occurring in swamps, along stream courses and lake shores, and in springy places.

Range — Newfoundland westward to the North West Territory in Canada, in the United States from Maine to eastern Montana, south to southern Pennsylvania, Kentucky and Nebraska. Zones A, **B**, **C**, and D.

Uses — Of slight economic importance. The tree deserves consideration ornamentally because of its dark green, shining foliage which resembles that of the Bay-leaved Willow.



Crack Willow, Brittle Willow

Salix fragilis L. [Salix viridis Fries.; Salix Russelliana Sm.]

1. A twig showing staminate aments x ½
2. A staminate flower, axile view x 5
3. A twig showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A twig with mature leaves x ½
6. Portion of twig showing mature aments x ½
7. Mature capsule x 4
8. Comose seed x 4
9. Winter twig x ½
10. Portion of leaf-margin, enlarged

SALICACEAE

Salix fragilis L. [Salix viridis Fries.; Salix Russelliana Sm.]

Crack Willow, Brittle Willow

Habit — A large tree sometimes attaining a height of 60–80 feet with a trunk diameter of 3–4 feet. Crown wide and rounded, consisting of upright and ascending wide-spreading branches.

Leaves — Alternate, petioled, lanceolate, 3–6 inches long, ¾–1½ inches wide, acuminate at the apex, cuneate at the base, finely and glandular serrate, at maturity coriaceous, dark green and glabrous above, paler and somewhat glaucous below. Stipules semi-cordate, glandular-toothed, fugacious.

Flowers — Appearing in April and May, dioecious, glandular, borne in the axils of ovate, rather blunt and hairy, persistent scales, the whole forming densely flowered aments terminal on short, leafy branchlets. Staminate aments narrowly oblong to conic, ¾–2½ inches long. Pistillate aments linear-cylindrical, of similar size. Stamens 2, with free, smooth filaments and yellow anthers. Pistil solitary, consisting of a smooth, narrowly ovoid, short-stalked ovary, a short style and 2 spreading stigmas.

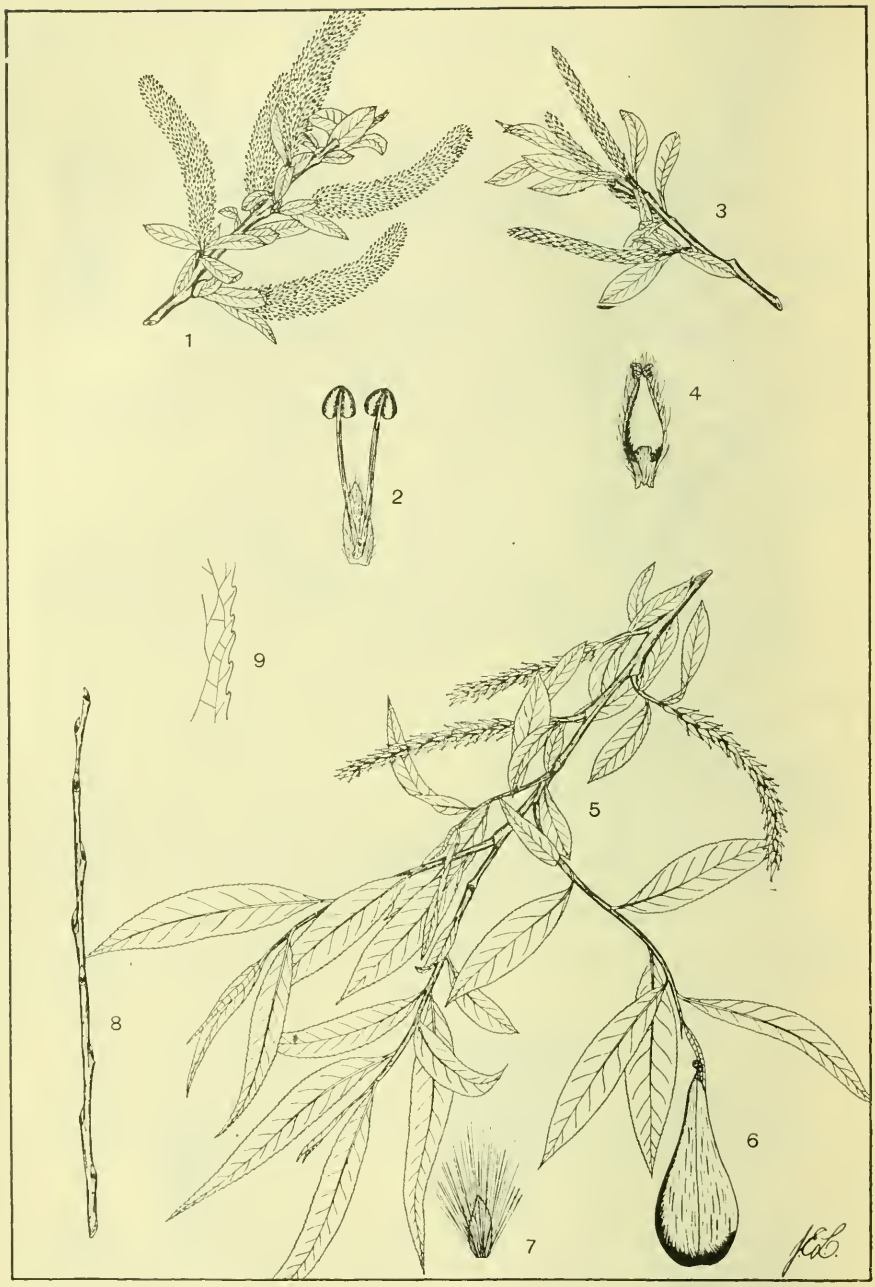
Fruit — A short-pedicellate, glabrous, long-conical capsule, opening at maturity by 2 opposite sutures to set free the minute, comose seeds.

Winter characters — Twigs somewhat angular, slender, at first finely hairy, reddish to yellowish brown, finally smooth, lustrous, brown, lenticellate, with raised leaf-scars, very brittle at the base. Terminal bud lacking. Lateral buds 1-scaled, oblong-ovate, bluntly acute, and smooth, 1/16–¼ of an inch long. Mature bark gray or grayish brown, thick, with narrow, scaly, anastomosing ridges separated by rather broad furrows.

Habitat — More cosmopolitan in distribution than Weeping Willow, thriving well on deep, moist, upland soils as well as along stream courses, margins of ponds, etc.

Range — A native of Europe and Asia, long introduced into this country for ornament and shade. Naturalized in the eastern states and Canada through natural cuttings. Common along our streams and rivers, the brittle twigs snapping off with a cracking sound, falling, and eventually taking root. Zones A, B, and C.

Uses — Of no commercial significance in this country aside from ornament and shade. Occasionally used for light fuel and charcoal. In the Old World, the trees are pollarded where fuel is scarce or are sometimes sawed into lumber.



Golden Osier

Salix alba, var. vitellina (L.) Koch. [Salix vitellina L.; Salix blanda Anders.]

1. A twig showing staminate aments x ½
2. A staminate flower, axile view x 5
3. A twig showing pistillate aments x ½
4. Pistillate flower, axile view x 5
5. A twig showing mature leaves and fruiting aments x ½
6. Mature capsule x 4
7. Comose seed x 4
8. Winter twig x ½
9. Portion of leaf-margin, enlarged

SALICACEAE

Salix alba, var. vitellina (L.) Koch. [Salix vitellina L.; Salix blanda Anders.]

Golden Osier

Habit — A large tree, under favorable conditions sometimes becoming 70–100 feet in height with a trunk diameter of 3–6 feet. Bole short, stout, irregular, dividing near the ground into several large, obliquely ascending branches which form a somewhat irregular, broad and rounded crown.

Leaves — Alternate, short-petioled, lanceolate to oblong-lanceolate, 2–5 inches long ⅓–⅔ of an inch wide, acuminate at the apex, wedge-shaped at the base, finely serrate, at maturity dark green and glabrous or slightly hairy above, glaucous, glabrous or close silky-white hairy beneath. Stipules ovate-lanceolate, fugacious.

Flowers — Appearing in April or May, dioecious, glandular, borne in the axils of yellow, narrowly ovate bracts, the whole forming aments terminal on short, leafy branchlets. Staminate aments oblong-cylindrical, densely flowered, 1–2½ inches long, yellowish. Pistillate aments linear-cylindrical and whitish at maturity. Stamens 2, with long, smooth filaments and yellow anthers. Pistil solitary, consisting of a smooth, short-pedicellate, narrowly ovoid ovary and 2 nearly sessile stigmas.

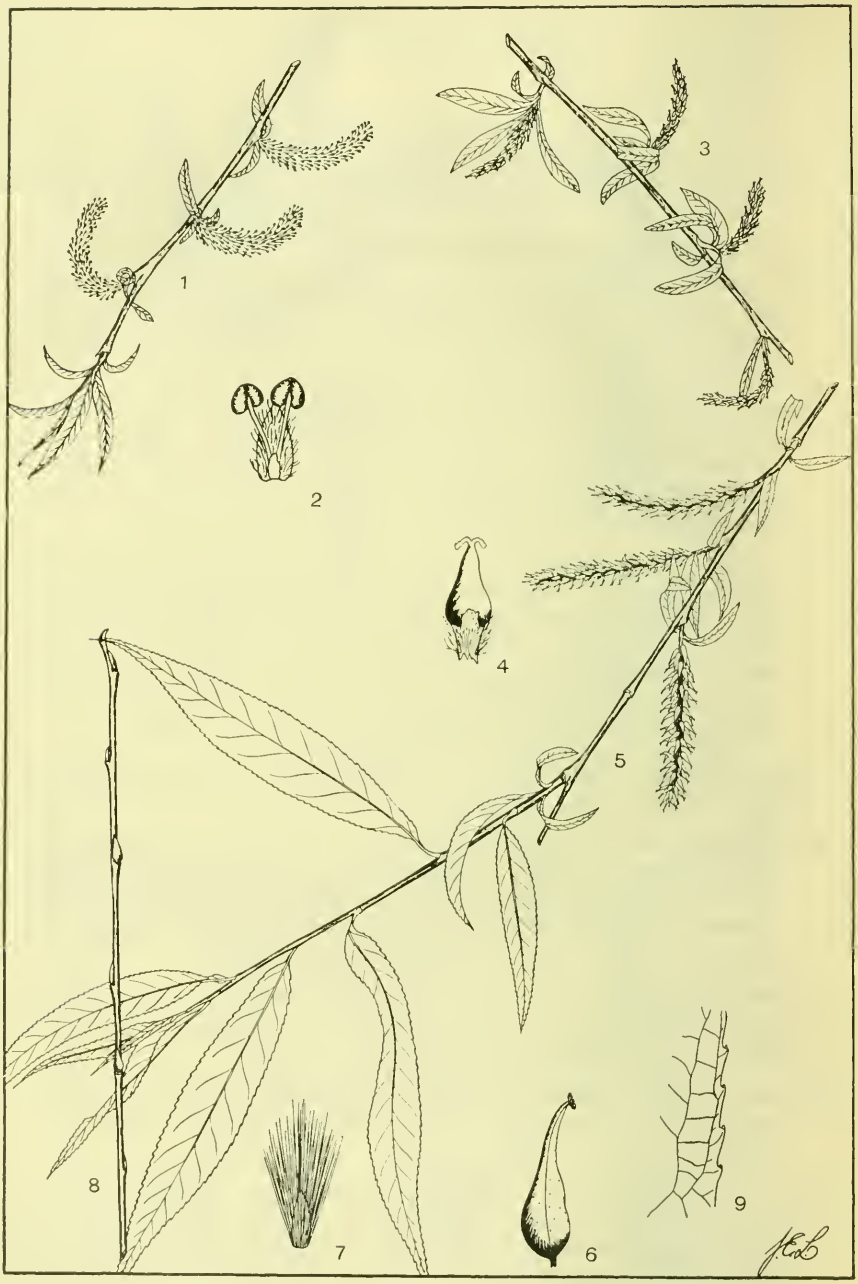
Fruit — A brownish, nearly sessile, smooth, ovoid-conic capsule, opening by 2 opposite sutures to set free the minute comose seeds.

Winter characters — Twigs slender, rather brittle at the base, finely hairy at first, at length smooth and lustrous, bright yellow, becoming yellowish brown. Terminal bud lacking. Lateral buds 1-scaled, oblong to ovoid, rounded at the apex, closely appressed, greenish yellow. Mature bark dark gray, deeply furrowed, with prominent, scaly ridges.

Habitat — Typically found along stream courses where there is abundant moisture, spreading by suckers and natural cuttings, rarely through seeds. Thrives well on moist uplands.

Range — A species originally introduced from Europe for shade and ornament, now widely naturalized in eastern North America. Zones A, B and C.

Uses — Of value chiefly as a shade and ornamental tree. Sometimes planted along water courses to prevent erosion as it is readily propagated by cuttings and grows rapidly. Wood light, soft, close-grained, tough, light brown with thick, nearly white sapwood. Used for light fuel and charcoal.



Weeping Willow

Salix babylonica L. [S. pendula Moench.]

1. A twig showing staminate aments x ½
2. A staminate flower, axile view x 5
3. A twig showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A pendant twig showing mature leaves and aments x ½
6. Mature capsule x 4
7. Comose seed x 4
8. Winter twig x ½
9. Portion of leaf-margin, enlarged

SALICACEAE

Salix babylonica L. [S. pendula Moench.]

Weeping Willow

Habit — A tree of characteristic habit, at maturity sometimes attaining a height of 60–75 feet with a short, stout trunk 2–6 feet in diameter. Crown broad, globose to globose-oblong, consisting of arching limbs which bear long, pendant, leafy twigs, giving the tree a very bizarre appearance.

Leaves — Alternate, petioled, pendant, linear-lanceolate to lanceolate, 3–6 inches long, 2/5–3/5 of an inch wide, long attenuate at the apex, wedge-shaped at the base, finely serrate, at maturity dark green and glabrous above, pale glaucous green beneath. Stipules small, semicordate, fugacious.

Flowers — Appearing with the leaves in April and May, dioecious, glandular, borne in the axils of ovate-lanceolate, greenish yellow bracts, the whole forming aments terminal on short, leafy, lateral branches. Staminate ament elongate-cylindrical, densely flowered and usually curved, yellowish, 1–2 inches long. Pistillate aments linear-cylindrical and greenish at maturity. Stamens 2, with rather short, smooth filaments and yellow anthers. Pistil solitary, consisting of an ovate, nearly sessile, smooth ovary, a short style and 2 spreading stigmas.

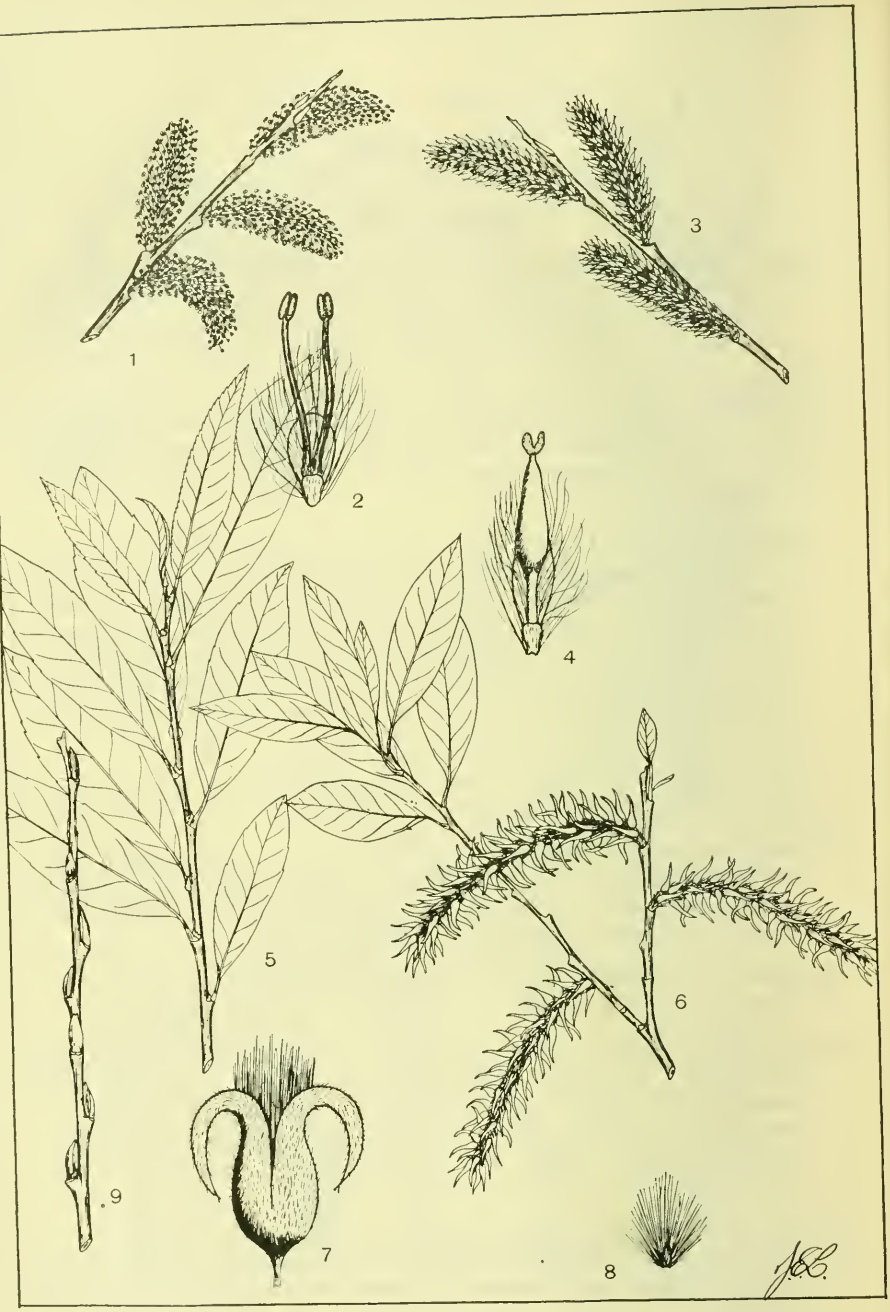
Fruit — A smooth, beaked, ovate, pale brown capsule opening by 2 sutures at maturity to set free the minute, comose seeds.

Winter characters — Twigs slender, yellowish green to brown, smooth, somewhat lustrous, drooping. Terminal bud lacking. Lateral bud 1-scaled, oblong-ovate, acute, appressed, 1/6–1/4 of an inch long. Mature bark gray, rather smooth, shallowly and reticulately ridged.

Habitat — A moisture-loving species thriving along streams, about lakes and ponds or on sites where the water table is close to the surface.

Range — Originally a native of Asia, whence its name, "babylonica," from Babylonia. Now widely cultivated in Europe and North and South America. Established in many places through natural cuttings, the twigs falling upon the surface of the water, and floating away to eventually find lodgment farther down, taking root, and growing into trees. Zones A, B, and C.

Uses — Widely used for ornament and shade, especially about artificial ponds and lakes in city and suburban parks. Of no significance in this country from the standpoint of lumber. A number of horticultural varieties are recognized.



Glaucous Willow, Pussy Willow

Salix discolor Muhl.

1. A twig showing staminate aments x ½
2. A staminate flower, axile view x 5
3. A twig showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A twig with mature leaves x ½
6. A twig showing leaves and fruiting aments x ½
7. Mature capsule x 2
8. Comose seed x 5
9. Winter twig x ½

SALICACEAE

Salix discolor Muhl.

Glaucous Willow, Pussy Willow

Habit — Usually shrubby with many ascending branches, occasionally a small tree 15–25 feet in height with a short bole 5–8 inches in diameter. Crown round-topped, consisting of stout, ascending branches and twigs.

Leaves — Alternate, petioled, in the typical form lanceolate to elliptic, 3–5 inches long, ¾–1 inch wide, acute at the apex, wedge-shaped at the base, irregularly crenate-serrate or entire and revolute on the margin, at maturity thick and subcoriaceous, bright green and glabrous above, pale white-glaucous beneath. Stipules lunate, foliaceous, fugacious. Leaves very variable in size and form, running into several varieties.

Flowers — The first of the willows to blossom in the spring, the flower buds beginning to open in March and April. Flowers dioecious, glandular, borne in the axils of oblong-obovate, reddish brown, copiously hairy scales, the whole forming stout, nearly sessile, oblong-cylindrical aments about 1 inch long appearing before the leaves from axillary buds along the stout twigs. Stamens 2, with elongated, smooth filaments and yellow anthers. Pistil solitary, consisting of a villous, oblong-cylindrical, attenuated, long-stalked ovary and a short style with spreading, entire stigmas.

Fruit — A large, pale pubescent, long-beaked, stalked, light brown capsule, ⅕–¼ of an inch long, opening at maturity by 2 opposite sutures to set free the minute, comose seeds.

Winter characters — Twigs stout, lenticellate, terete, at first somewhat pubescent, at length dull reddish purple and glabrous. Terminal bud lacking. Lateral buds 1-scaled, ovate, flattened and acute at the apex, dark reddish purple and lustrous, about ⅜ of an inch long. Mature bark thin, light brown tinged with red, divided by shallow fissures into thin, oblong, deciduous scales.

Habitat — Wet marshy sites along stream courses and lakes, hanging bogs, spring holes, and low meadows.

Range — Nova Scotia and Manitoba, Maine to northeastern North Dakota, south to Delaware, Kentucky and Missouri. Zones A, B, **C**, and **D**.

Uses — Of little commercial significance. The aments are showy in the spring and are sometimes collected for ornament.

Bebb Willow, Beaked Willow

Salix rostrata Rich. [Salix Bebbiana Sarg.]

1. A twig showing staminate aments x ½
2. A staminate flower, axile view x 5
3. A twig showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A twig with mature leaves x ½
6. A twig showing leaves and fruiting aments x ½
7. Mature capsule x 2½
8. Comose seed x 5
9. Winter twig x ½

SALICACEAE

Salix rostrata Rich. [Salix Bebbiana Sarg.]

Bebb Willow, Beaked Willow

Habit — Usually shrubby and 6–10 feet in height, occasionally a small bushy tree 20–25 feet high with a short, often oblique and twisted trunk 5–8 inches in diameter. Crown broad and rounded.

Leaves — Alternate, short-petioled, obovate to elliptic-lanceolate, 1–3 inches long, ½–1 inch wide, acute at the apex, wedge-shaped or rounded at the base, remotely serrate or entire, at maturity thick, dull green and rugose-veined above, pale green or grayish pubescent beneath. Stipules foliaceous, semicordate fugacious.

Flowers — Appearing in April and May, dioecious, glandular, borne in the axils of oblong, rounded scales, the whole forming aments terminal on short leafy branchlets. Staminate aments cylindrical-obovate, densely flowered, ¾–1 inch long. Pistillate aments oblong-cylindrical, loosely flowered, about 1 inch in length. Stamens 2, with free, smooth filaments. Pistil solitary, consisting of a gray-pubescent, narrowly ovoid, stalked ovary, prolonged into a slender beak capped by 2 broad, sessile stigmas.

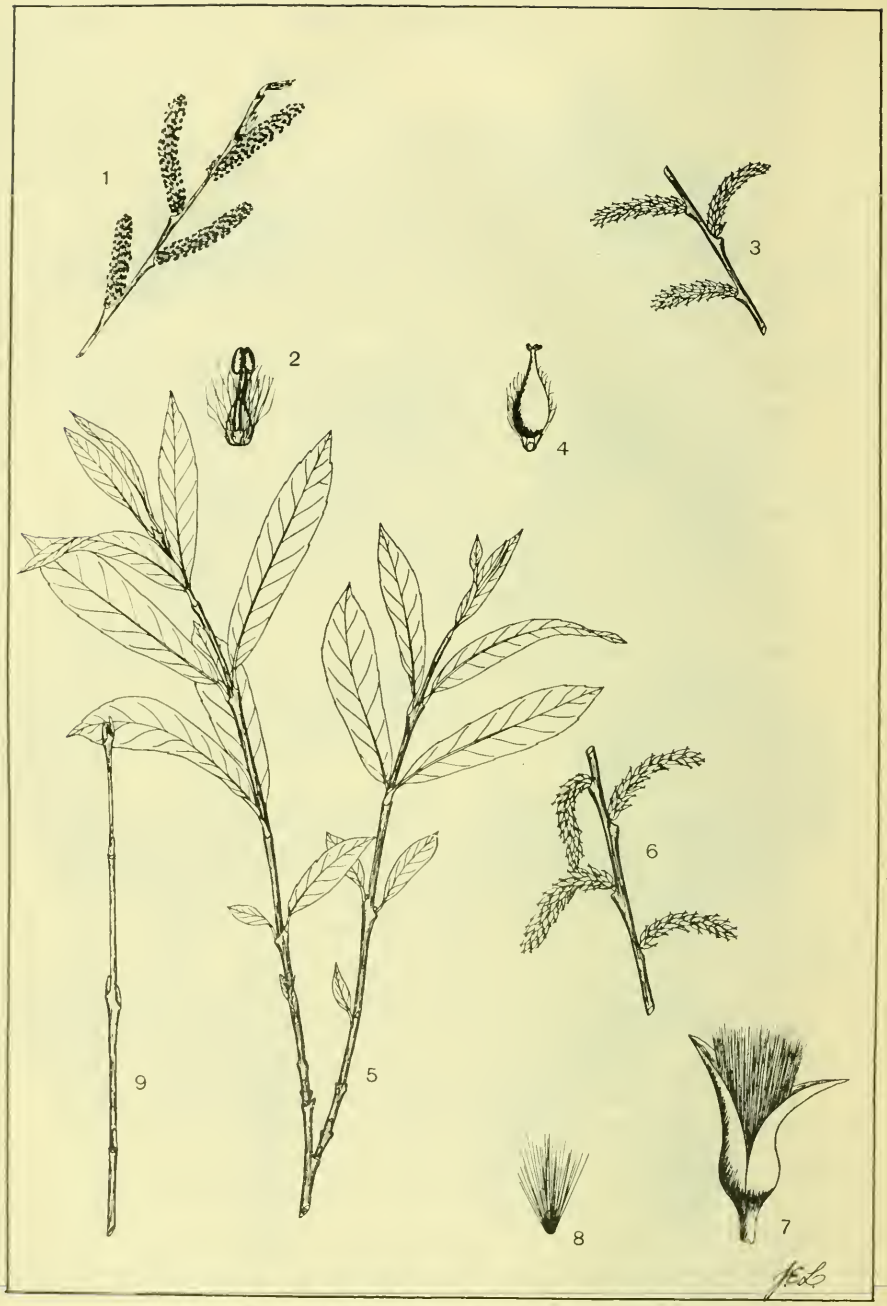
Fruit — A gray-pubescent, ovoid, beaked long-pedicellate capsule, ¼–5/16 of an inch long, opening at maturity by 2 opposite sutures to set free the minute, comose seeds.

Winter characters — Twigs slender, at first hairy, during the first winter smooth, purplish to brown, lenticellate, with elevated leaf-scars. Terminal bud lacking. Lateral buds 1-scaled, oblong, rounded at the apex, closely appressed, chestnut-brown, about ¼ of 1 inch long. Mature bark reddish green to grayish, smooth or shallowly furrowed.

Habitat — Has a wider range of habitat than most willows, occurring in swamps, along borders of streams and lakes, likewise on drier upland sites on open hillsides, slashes and burns, often on comparatively dry soil.

Range — A widely distributed species ranging from Newfoundland to Alaska, south in the United States to New Jersey, Pennsylvania and Iowa, southwest through Colorado to Arizona. Zones A, B, C, and D.

Uses — Of no economic importance.



Purple Willow, Purple Osier

Salix purpurea L. [Salix Forbyana Sm.]

1. A twig showing staminate aments x ½
2. A staminate flower, axile view x 5
3. A twig showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A twig with mature leaves x ½
6. Portion of a twig showing fruiting aments x ½
7. Mature capsule x 5
8. Comose seed x 5
9. Winter twig x ½

SALICACEAE

Salix purpurea L. [Salix Forbyana Sm.]

Purple Willow, Purple Osier

Habit — Usually a shrub, occasionally a small tree 25–30 feet in height with a rather broad, rounded crown and short, irregular trunk 5–8 inches through. Branches ascending, bearing long, slender, flexuous and somewhat pendulous twigs.

Leaves — Alternate or often subopposite, short-petioled, oblanceolate to spatulate, 1–3 inches long, ¼–½ wide, acute at the apex, narrowed and rounded at the base, entire or slightly serrulate, at maturity dark dull green and very smooth above, paler, smooth, and glaucous below. Stipules small, fugacious.

Flowers — Appearing in April and May, dioecious, glandular, borne in the axils of blunt, hairy, purplish, persistent bracts, the whole forming densely flowered, narrowly cylindrical, nearly sessile aments which measure 1–2 inches in length and appear before the leaves on twigs of the preceding season. Stamen 1, with free, smooth filament and orange or reddish yellow anther. Pistil solitary, consisting of a grayish-tomentose, ovoid-conical, sessile ovary, a short style and 2 small stigmas.

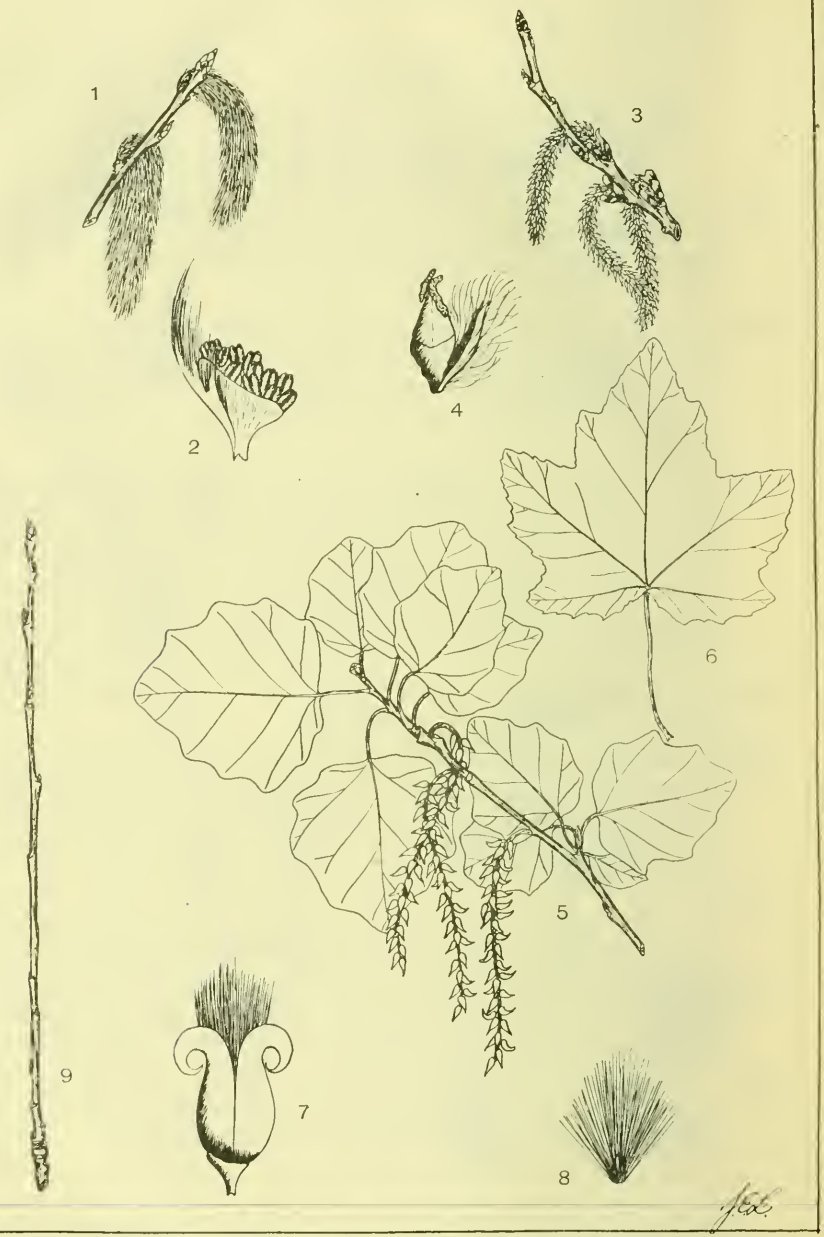
Fruit — A sessile, grayish-tomentose, ovoid, obtuse capsule, about 1/12 of an inch long, enclosing minute, comose seeds.

Winter characters — Twigs long, slender, flexuous, glabrous, purplish, sometimes glaucous, lenticellate, with raised leaf-scars. Terminal bud lacking. Lateral buds alternate or subopposite, ovate-oblong, acute smooth, ⅛–¼ of an inch long. Mature bark grayish black, shallowly fissured and narrowly ridged, the ridges scaly at the surface.

Habitat — Grown extensively for wickerware on low, wet, alluvial soils. A water-loving species requiring a moist (not necessarily wet) soil.

Range — A European species largely cultivated at Liverpool, N. Y., and elsewhere in the East for wickerware. An occasional "escape" throughout the eastern and central states, usually in wet situations. Zones A, B, and C.

Uses — An important osier-willow thriving well in New York State. This species may be grown profitably on low, wet, farm meadows that are unsuited for other crop. Occasionally grown ornamentally.



White Poplar, Silver-leaved Poplar, Abele

Populus alba L.

1. A twig-tip showing staminate aments x ½
2. A staminate flower, lateral view x 5
3. A twig-tip showing pistillate aments x ½
4. A pistillate flower, lateral view x 5
5. A twig with mature leaves and fruiting aments x ½
6. A leaf of *Populus alba, var. nivea* Wesm. x ½
7. Mature capsule x 2
8. Comose seed x 5
9. Winter twig x ½

SALICACEAE

Populus alba L.

White Poplar, Silver-leaved Poplar, Abele

Habit — A large tree, sometimes attaining a height of 80–100 feet with a trunk diameter of 2–4 feet, usually 40–70 feet tall. Crown irregular, open, broad and round-topped. Bole massive, breaking up 10–20 feet above the ground into stout, ascending limbs and arching, somewhat pendant twigs. Propagates naturally by suckers.

Leaves — Alternate, borne on long, slender, white-tomentose or nearly glabrate, terete petioles, in the type form suborbicular to broadly ovate, obtuse or acute at the apex, truncate or cordate at the base, irregularly sinuate-dentate, 2–4 inches long, at maturity firm, dark green, smooth, and somewhat lustrous above, white-tomentose or pale-glabrate below. The variety *Populus alba, var. nivea* Wesm. with palmately 3–5-lobed leaves which are white velvety-tomentose below, is a common "escape" in this country.

Flowers — Appearing before the leaves from separate flower-buds, dioecious, borne in the axils of obovate, dentate, hairy scales, the whole forming pendulous, densely flowered, hairy, cylindrical aments 2–3 inches long. Perianth wanting. Stamens 6–10, with short slender filaments and pale purple anthers, inserted on the oblique, cup-shaped disk. Pistil solitary, enclosed at the base by the closely appressed disk, consisting of an ovoid ovary and 2 nearly sessile, 2-lobed, yellow stigmas.

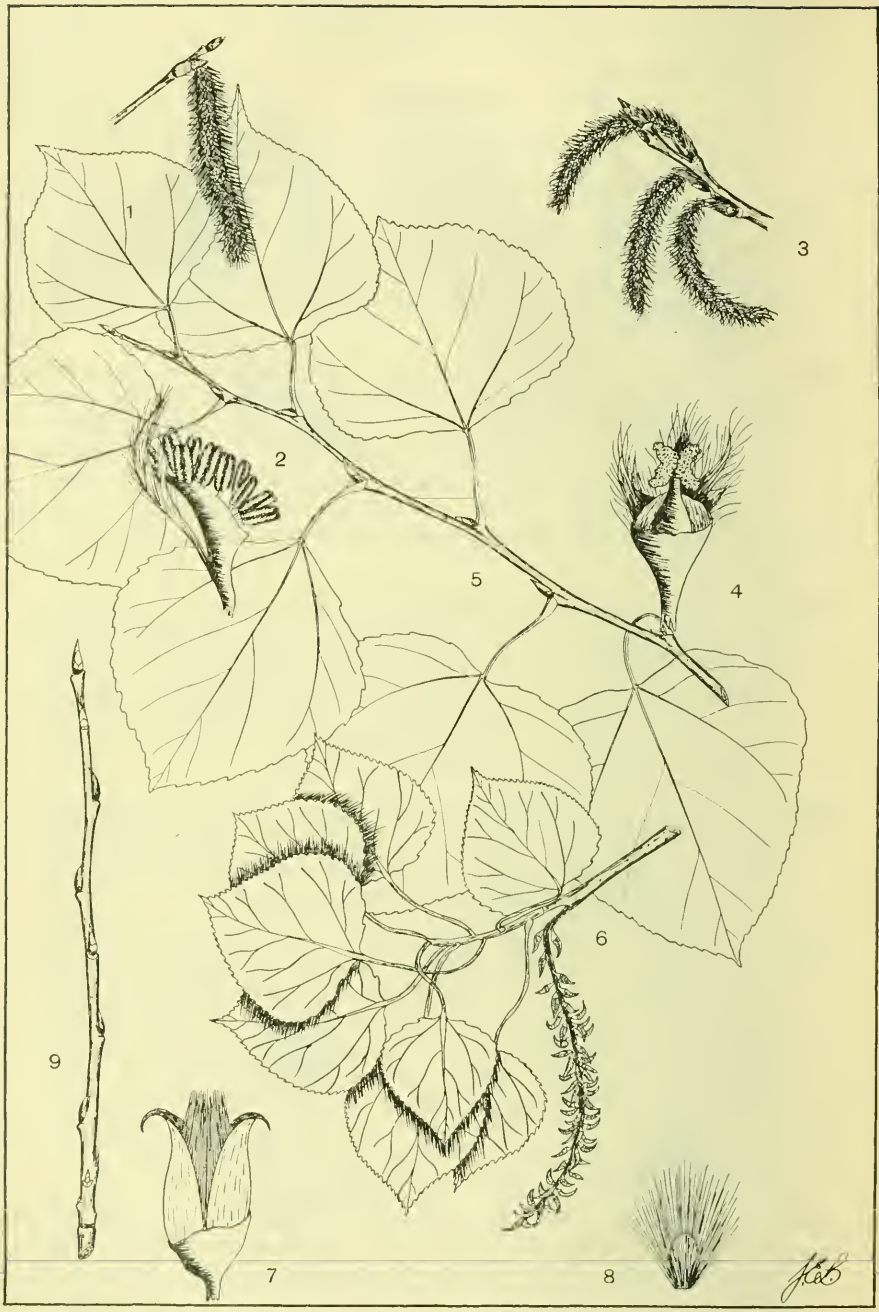
Fruit — An ovoid-oblong, canescent, short pedicellate capsule, about 3/16 of an inch long. The capsules are borne in naked, pendant, rather stout-stemmed aments 2–2½ inches long, mature in late May or June, and open by 2 valves to set free the minute, white-comose seeds.

Winter characters — Twigs rather stout, lenticellate, purplish or olive-brown, white-tomentose, becoming smooth and gray the second season. Flower- and leaf-buds distinct. Leaf-buds ovate-oblong, acute, white-downy, ⅕–¼ of an inch long. Flower-buds ovoid, blunter and more divergent. Bark on young trees or large limbs grayish or greenish white, smooth or roughened by brownish warty excrescences. Mature bark brownish black. Deeply fissured, with rough, irregular ridges.

Habitat — A rapidly growing tree thriving best in deep, moist, alluvial soils where a constant supply of moisture is assured.

Range — Native of southern Europe, Asia and northern Africa. Long cultivated as an ornamental and shade tree about dooryards and estates, spreading readily, chiefly through its stoloniferous roots. Zones A, B, and C.

Uses — Valuable chiefly as an ornamental tree because of its showy leaves. Wood light, soft, weak, close-grained, pale reddish yellow with nearly white sapwood. Occasionally used for light fuel in this country, and abroad for packing cases and flooring.



Trembling Aspen, American Aspen, Popple

Populus tremuloides Michx.

1. A twig-tip showing staminate ament x ½
2. A staminate flower, lateral view x 5
3. A twig-tip showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A twig showing mature leaves x ¼
6. A twig showing immature foliage and fruiting ament x ½
7. Mature capsule x 4
8. Comose seed x 5
9. Winter twig x ½

SALICACEAE

Populus tremuloides Michx.

Trembling Aspen, American Aspen, Popple

Habit — At maturity usually a small tree 30–60 feet in height with a trunk diameter of 1–2 feet, under optimum conditions sometimes 100 feet tall. Crown narrow, round-topped, open and irregular, consisting of slender, somewhat ascending branches which often droop at the tip. Bole in large trees with little taper until the crown is reached, in smaller trees tapering gradually into the crown. Propagates by root suckers.

Leaves — Alternate, broadly ovate to orbicular, acute at the apex, rounded, cordate or broadly cuneate at the base, finely serrate, 1½–3 inches in diameter, when they first appear smooth, lustrous, pale green with ciliate margins, at maturity thin, firm, smooth, dark green and lustrous above, dull yellowish green and smooth below.

Flowers — Appearing in late March and April before the leaves from separate flower-buds, dioecious, borne in the axils of laciniately 3–5-lobed, hairy scales, the whole forming cylindrical, hairy aments, 1½–2½ inches long. Perianth wanting. Stamens 6–12 with short, slender filaments and reddish anthers, inserted on an oblique shallow disk. Pistil solitary, enclosed at the base in the tubular, slightly oblique disk, consisting of a conical, green, puberulous ovary, a short style and 2 spreading, lobed stigmas.

Fruit — A curved, pale green, thin-walled capsule, about ¼ of an inch long. The capsules are borne rather loosely in naked, pedunculate aments 3–4 inches long, mature in May and June before the leaves have attained full size, and open by opposite sutures to set free the minute, light brown, white-comose seeds.

Winter characters — Twigs rather slender, lenticellate, smooth and lustrous, reddish brown, at length dark gray and roughened by the leaf- and lateral branch-scars. Flower- and leaf-buds distinct. Leaf-buds conical and somewhat curved, slightly resinous, acute, about ¼ of an inch long, covered by 6–7 lustrous and glabrous, reddish brown scales scarious on the margins. Flower-buds similar but larger, more obtuse and divergent. Mature bark appearing rather tardily at the base of the old trees, nearly black, thick, roughened by deep fissures and broad, flat ridges. Bark higher on the bole and on the larger limbs thinner, smooth, yellowish green to nearly white, roughened by areas of wart-like excrescences.

Habitat — A "weed" tree thriving on a variety of sites, swamps excepted, but preferring rather dry, upland soils. Frequent in slashes and burns, on abandoned fields, limestone hills, etc.

Range — A widely distributed transcontinental species extending from southern Labrador through the Hudson Bay region to Alasaka, south in the United States to northern Pennsylvania, Kentucky and Missouri, and in the west to Mexico and California. Zones B, C, and **D**.

Uses — Wood light, soft, weak, close-grained, light brown with nearly white sapwood. Largely used with Spruce and Fir in the manufacture of pulp. Occasionally sawed into lumber and used for turnery, etc. Like the Large-toothed Aspen, the tree is valuable as a cover tree, establishing itself quickly in slashes and burns and protecting the soil until more valuable, slower-growing species can dominate the terrain.

Large-toothed Aspen

Populus grandidentata Michx.

1. A twig-tip showing staminate aments x ½
2. A staminate flower, lateral view x 5
3. A twig-tip showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A twig showing mature leaves x ½
6. A twig showing immature foliage and fruiting aments x ½
7. Mature capsule x 4
8. Comose seed x 5
9. Winter twig x ½

SALICACEAE

Populus grandidentata Michx.

Large-toothed Aspen

Habit — A tree at maturity sometimes attaining a height of 60–75 feet with a trunk diameter of 1–2 feet, usually 25–50 feet tall. Crown narrow, round-topped, open, consisting of slender, rather rigid branches and stout twigs. This species propagates itself readily by root suckers.

Leaves — Alternate, borne on long, slender, flattened petioles, broadly ovate to orbicular, acute at the apex, rounded or broadly cuneate at the base, coarsely and irregularly dentate, 3–6 inches long, 2–4 inches wide, at first densely white-tomentose, at maturity thin but firm in texture, dark green and smooth above, paler and smooth below. Stipules linear, ½–¾ of an inch long, fugacious.

Flowers — Appearing in late March and April before the leaves from separate flower-buds, dioecious, borne in the axils of pale, gray-hairy scales which are divided above into 4–6 short, acute lobes, the whole forming cylindrical, hairy aments 1½–2½ inches long. Perianth wanting. Stamens 6–12, with short, slender filaments and reddish anthers, inserted on an oblique, shallow disk. Pistil solitary, enclosed at the base in the tubular, slightly oblique disk, consisting of an oblong-conical, green, puberulous ovary, a short style, and 2 spreading, lobed stigmas.

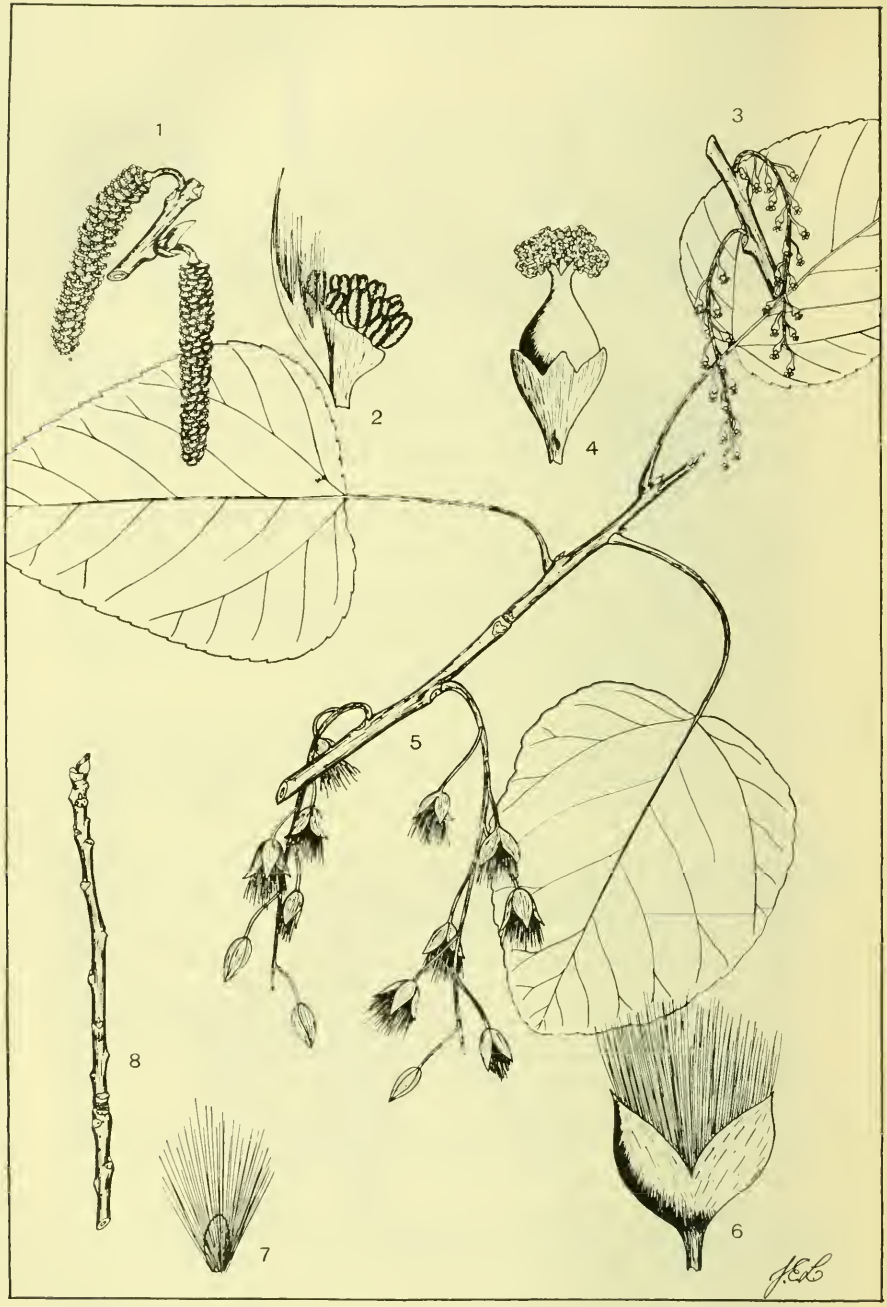
Fruit — A curved, oblique, conical, pedunculate capsule, at maturity pale green and puberulous, thin-walled, ⅛–¼ of an inch long. The capsules are borne loosely in naked, pedunculate aments 5–6 inches long and open in May as the leaves unfold to set free the minute, brown, white-comose seeds.

Winter characters — Twigs rather stout, lenticellate, smooth and lustrous or gray-pubescent (especially toward the apex), dark reddish or yellowish brown, at length dark gray and roughened by the leaf- and lateral twig-scars. Flower- and leaf-buds distinct. Leaf-buds broadly ovate, divergent, light chestnut-brown, grayish puberulous, covered by 6–7 rounded scales (the first scale anterior), about ⅛ of an inch long. Flower-buds similar but larger and more strongly divergent. Mature bark appearing tardily at the base of old trees, dark brownish black, thick, firm, roughened by fissures and broad, flat ridges. Bark higher on the bole and on the larger limbs thinner, smooth, light greenish gray.

Habitat — A "weed" tree attaining its best development on rich, deep, moist soils, but occurring over a wide range of habitats on dry, upland, sandy or stony sites.

Range — Nova Scotia southwest through southern Quebec and Ontario, in the United States from Maine to Minnesota, south along the Appalachians to North Carolina. Zones B, C, and **D.**

Uses — Most important silviculturally because of the rapidity with which it comes in on slashes and burns, establishing a forest cover which permits more valuable species to rehabilitate themselves. Wood light, soft, weak, close-grained, pale brown with nearly white sapwood. Used for excelsior, pulp and occasionally for wooden ware.



Swamp Cottonwood, Swamp Poplar, Black Cottonwood

Populus heterophylla L.

1. Portion of a twig showing staminate aments x ½
2. A staminate flower, lateral view x 5
3. Portion of a twig showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A twig showing mature leaves and fruiting aments x ½
6. Mature capsule x 2
7. Comose seed x 3
8. Winter twig x ½

SALICACEAE

Populus heterophylla L.

Swamp Cottonwood, Swamp Poplar, Black Cottonwood

Habit — In New York State a small tree 25–40 feet in height with a trunk diameter of 12 inches or less, farther south sometimes 90–100 feet tall. Crown rather narrow, open, round-topped, consisting of a few large limbs which are irregularly arranged. Bole in large trees straight and columnar, bearing a high crown. In small trees it is much shorter and tapering, and continues into the crown.

Leaves — Alternate, borne on long, hairy, terete petioles, broadly ovate, obtuse or subacute at the apex, rounded to cordate at the base, crenate, 4–8 inches long 3–5 inches wide, at first densely hoary-pubescent, at maturity thin but firm in texture, dark green and smooth above, paler and glabrous below. Stipules linear-lanceolate, ½–1 inch long, fugacious.

Flowers — Appearing in April or May before the leaves from separate flower-buds, dioecious, borne in the axils of brown, oblong-obovate scales which are divided above into numerous filiform lobes, the whole forming aments. Staminate aments cylindrical, stout, densely flowered, at first short and erect, finally pendant, 2–2½ inches long. Pistillate aments broad, cylindrical, few flowered, pendant, 1–2 inches long. Stamens 12–20, with short, slender filaments and dark red anthers, inserted on an oblique shallow disk. Pistil solitary, enclosed at the base in the campanulate, lobed, deciduous disk, consisting of an ovoid ovary, a short style and 2–3 spreading, lobed stigmas.

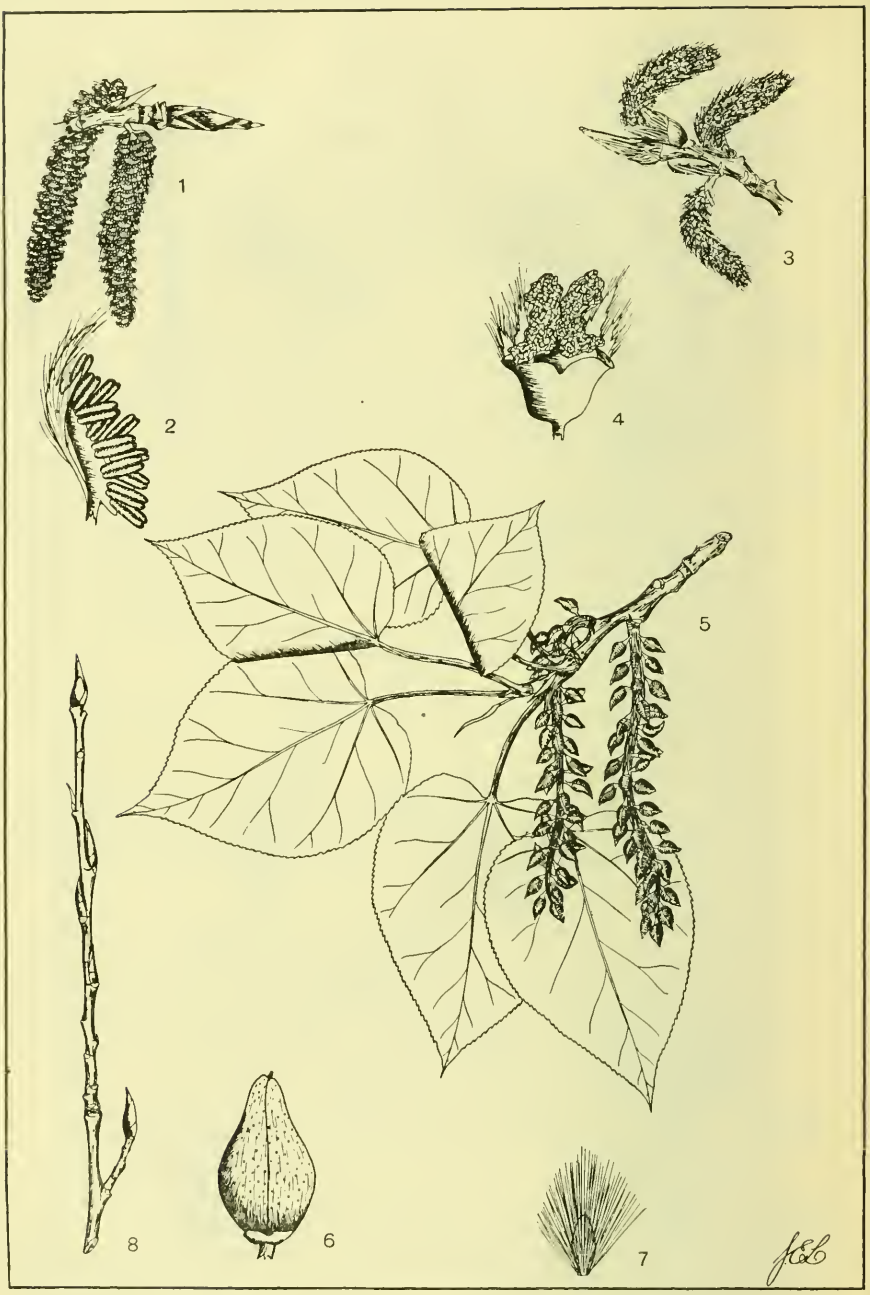
Fruit — An ovoid-oblong smooth, thick-walled, long-pedicellate, reddish brown capsule, about ¼ of an inch long. The capsules are borne loosely in naked, erect or ascending aments 4–6 inches long and open in May when the leaves are about half grown by 2–3 sutures to set free the minute, dark brown, white-comose seeds.

Winter characters — Twigs stout, lenticellate, at first velvety, soon becoming lustrous or dull grayish or reddish brown, with conspicuous orange-colored pith. Flower- and leaf-buds distinct. Leaf-buds ovate, acute, puberulous, reddish brown, covered by 4–7 scales, about ¼ of an inch long. Flower-buds similar, broadly ovate, more strongly divergent, about ½ of an inch long. Mature bark light reddish brown and thick, with narrow, shallow fissures and long, narrow, flat ridges.

Habitat — A moisture-loving tree occurring intermixed with other species in low, swampy situation, often where the soil is inundated for long periods each year.

Range — Connecticut south in the coastal swamps to Georgia, through the Gulf States to western Louisiana, thence north in the Mississippi basin to Kentucky and Missouri. Zone A.

Uses — Of little economic significance. Wood light, soft, weak, close-grained, pale brown with thin, brownish white sapwood. Occasionally sawed into lumber in the lower Mississippi basin.



Balsam Poplar, Tacamahac

Populus balsamifera L.

1. A twig-tip showing staminate aments x ½
2. A staminate flower, lateral view x 5
3. A twig-tip showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A twig showing mature leaves and fruiting aments x ½
6. Mature capsule x 3
7. Comose seed x 5
8. Winter twig x ½

SALICACEAE

Populus balsamifera L.

Balsam Poplar, Tacamahac

Habit — A tree attaining a height of 60–70 feet with a trunk diameter of 1–3 feet, under optimum conditions in the forest sometimes 100 feet tall. Crown rather narrow, irregular, open, bluntly pyramidal in exposed trees, consisting of stout, sparse, erect branches which are bushy at the ends. Propagates by root suckers.

Leaves — Alternate, borne on long, slender, smooth, terete petioles, ovate to ovate-lanceolate, acuminate at the apex, rounded or cordate at the base, finely crenate-serrate, 3–6 inches long, 1½–3 inches wide, at maturity thin but firm in texture, dark green and lustrous above, paler and somewhat rusty, and reticulate-veined below. Stipules oblong-lanceolate, ciliate, about ⅖ of an inch long, tardily fugacious.

Flowers — Appearing in April and May before the leaves from separate flower-buds, dioecious, borne in the axils of light brown, obovate, hairy, laciniate scales, the whole forming pendulous, densely flowered, hairy, cylindrical aments, 2½–4 inches long. Perianth wanting. Stamens 20–30, with short, slender filaments and light red anthers, inserted on an oblique, short-stalked, shallow disk. Pistil solitary, enclosed at the base by the cup-shaped, slightly lobed disk, consisting of an ovoid, slightly 2-lobed ovary, and 2 large, nearly sessile stigmas.

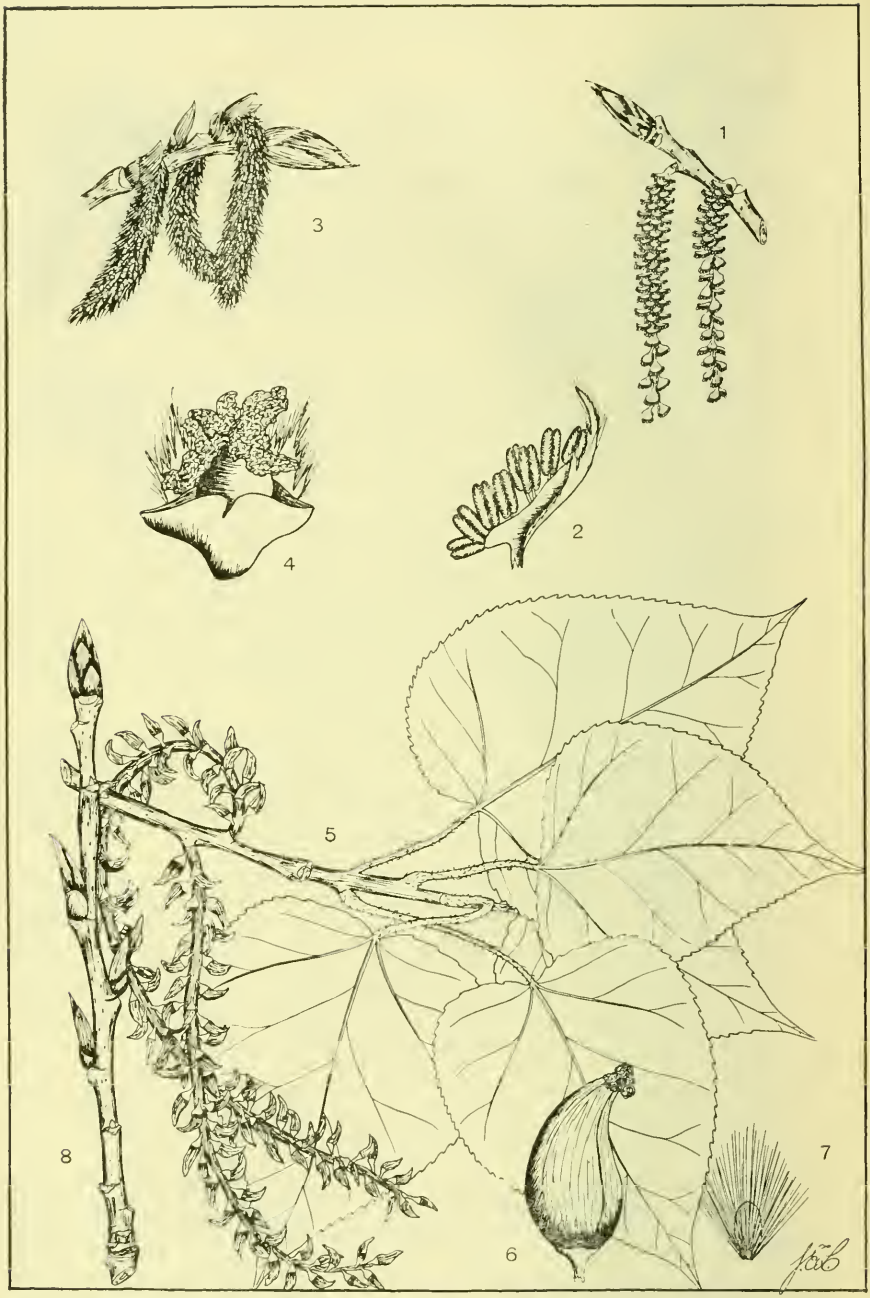
Fruit— An ovoid-oblong, light brown, thin-walled, pedunculate capsule, acute and often curved at the apex, about ¼ of an inch long. The capsules are borne rather closely in pedunculate, stout-stalked, naked aments 4–5 inches long and open by 2 opposite sutures in late May or June to set free the minute, pale brown, white-comose seeds.

Winter characters — Twigs stout, lenticellate, smooth, lustrous, bright reddish brown, at length dull orange and finally yellowish or greenish gray. Flower- and leaf-buds distinct. Leaf-buds ovate, acuminate, usually divergent, dark red, water-proofed with a fragrant, amber-colored resin which exhales a pleasing odor as the buds unfold in the spring, ½–1 inch long. Flower-buds similar but somewhat broader. Bark on young trunks and limbs smooth, light reddish brown. Mature bark dark gray tinged with red, thick, with narrow fissures and broad scaly ridges.

Habitat — Prefers alluvial soils in the bottom-lands of river valleys, along banks of streams and lake shores, borders of swamps, etc. A moisture-loving species, occasionally growing in drier situations.

Range — A transcontinental species widely spread throughout Canada from Labrador to Alaska, south into northern New England, New York, Michigan, Wisconsin, Minnesota, Nebraska, Montana, Nevada and Oregon. Zones C and **D.**

Uses — Wood light, soft, weak, close-grained, pale brown with thick, nearly white sapwood. Intermixed with that of other species in the manufacture of pulp. Occasionally manufactured into small wooden containers such as pails and boxes.



Balm of Gilead

Populus candicans Ait. [Populus balsamifera, var. candicans (Ait.) Gray]

1. A twig-tip showing staminate aments x ½
2. A staminate flower, lateral view x 5
3. A twig-tip showing pistillate aments x ½
4. A pistillate flower, axile view x 4
5. A twig showing mature foliage and fruiting aments x ½
6. Mature capsule x 2
7. Comose seed x 5
8. Winter twig x ½

SALICACEAE

Populus candicans Ait. | Populus balsamifera, var. candicans (Ait.) Gray |

Balm of Gilead

Habit — A tree at maturity 50–80 feet high with a trunk diameter of 2–4 feet, occasionally 100 feet tall. Crown rather broad, irregular and open, consisting of stout, sparse, spreading, somewhat drooping limbs. A short-lived tree propagating readily by suckers.

Leaves — Alternate, borne on long, slender, pubescent terete petioles, broadly ovate, acuminate at the apex, cordate or truncate at the base, coarsely crenate-serrate and ciliate on the margin, 3–6 inches long, 1½–4 inches wide, at maturity thin but firm in texture, dark green and lustrous above, paler and hairy on the veins beneath. Stipules oblong, lanceolate, ciliate, about ⅗ of an inch long, tardily fugacious.

Flowers — Appearing in April and May before the leaves from separate flower-buds, dioecious, borne in the axils of light brown, obovate, hairy, laciniate scales, the whole forming pendulous, densely flowered, cylindrical aments 2½–4 inches long. Perianth wanting. Stamens 20–30, with short, slender filaments and light red anthers, inserted on an oblique, short-stalked, shallow disk. Pistil solitary, enclosed at the base by the cup-shaped slightly lobed disk, consisting of an ovoid, slightly lobed ovary, and 2 large, sessile stigmas.

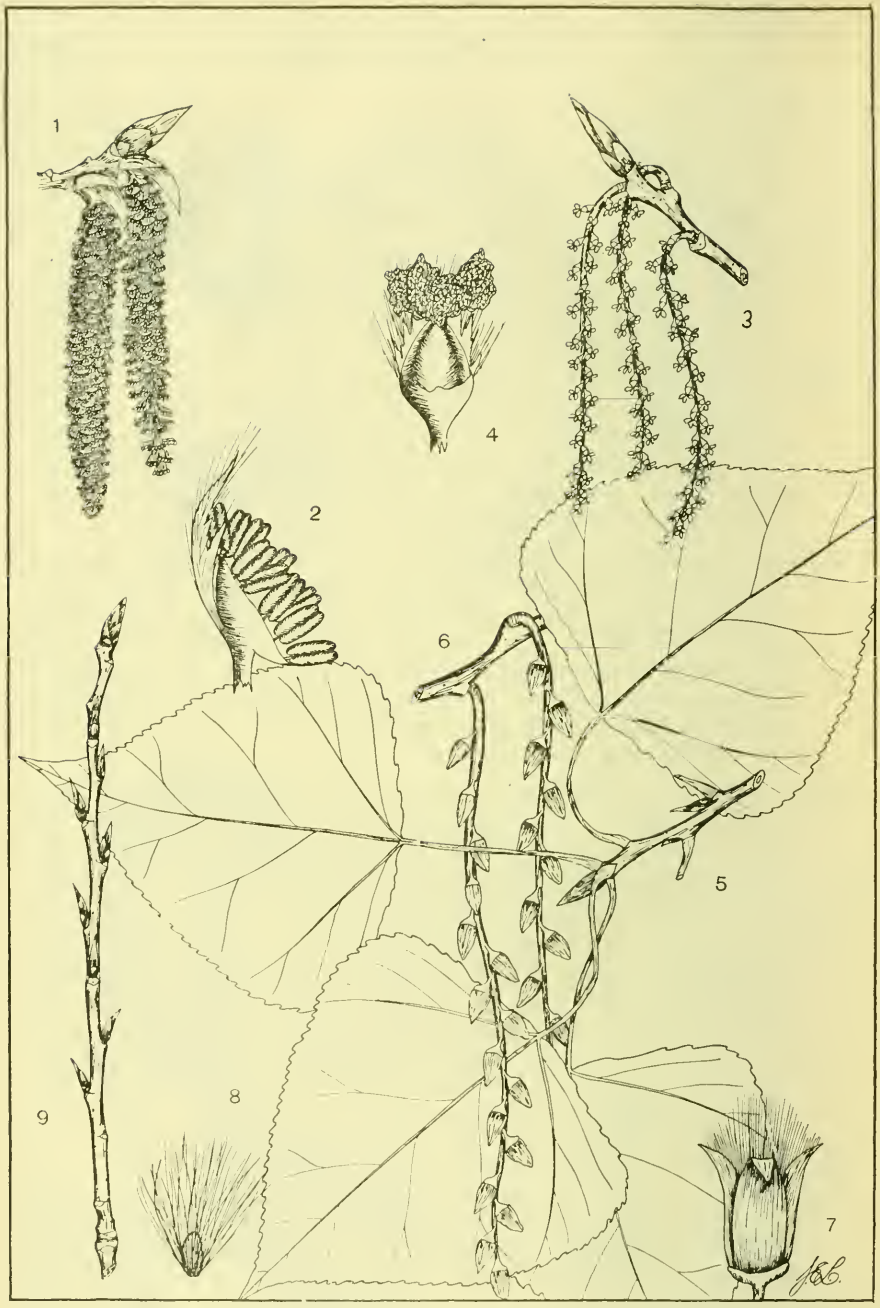
Fruit — A narrowly ovoid, pale brown, thin-walled, pedunculate capsule, acute and often curved at the apex, ¼–⅓ of an inch long. The capsules are borne rather loosely in pedunculate, stout-stalked, naked aments 4–6 inches long and open by 2 opposite sutures in late May or June to set free the minute, pale brown, white-comose seeds.

Winter characters — Twigs stout, lenticellate, smooth, lustrous, reddish brown, at length dull yellowish or greenish gray. Flower- and leaf-buds distinct. Leaf-buds narrowly ovate, acuminate, somewhat divergent, dark red, water-proofed with a very fragrant, amber-colored resin which exhales a pleasing odor as the buds unfold in the spring, ½–1 inch long. Flower-buds similar, usually broadly ovate. Mature bark dark gray, thick, with narrow fissures and broad, scaly ridges.

Habitat — In deep, moist soil about dwellings and dooryards.

Range — Imperfectly known. Widely planted in North America from Newfoundland to Alaska, south to Virginia and Missouri. Said to have come originally from the state of Michigan but now occurring as an "escape" about the dwellings of man.

Uses — A fast-growing species planted ornamentally about dwellings but not to be recommended because of its short life and unsightly appearance in age. Suckers from these trees are a nuisance about dooryards. Wood similar to that of Balsam Poplar and occasionally used for the same purposes.



Carolina Poplar, Cottonwood, Necklace Poplar

Populus deltoides Marsh. [Populus monilifera Ait. Populus canadensis, var. Eugenie Schelle.]

1. A twig-tip showing staminate aments x ½
2. A staminate flower, lateral view x 5
3. A twig-tip showing pistillate aments x ½
4. A pistillate flower, axile view x 5
5. A twig showing mature leaves x ½
6. Portion of twig showing fruiting aments x ½
7. Mature capsule x 2
8. Comose seed x 5
9. Winter twig x ½

SALICACEAE

Populus deltoides Marsh. [Populus monilifera Ait. Populus canadensis, var. Eugenie Schelle.]

Carolina Poplar Cottonwood, Necklace Poplar

Habit — A tree usually 50–70 feet in height with a trunk diameter of 2–3 feet, under optimum conditions sometimes 100 or more feet tall. Crown at first pyramidal, with age becoming rounded and open and nearly as broad as long. Limbs sparse, stout, ascending or the lower horizontal. Branchlets drooping. Bole tapering and continuous well into the high crown. Propagates naturally by suckers.

Leaves — Alternate, borne on long, slender, smooth, flattened petioles, broadly deltoid-ovate, acute at the apex, truncate or cuneate at the base, crenate-serrate, 3–5 inches long and broad, at maturity thick and firm in texture, light green, smooth and lustrous above, paler and smooth below. Stipules ligulate to linear-lanceolate, ½–1 inch long, fugacious.

Flowers — Appearing in April and May before the leaves from separate flower-buds, dioecious, borne in the axils of pale brown, hairy or glabrous, obovate, laciniate scales, the whole forming pendulous aments. Staminate aments cylindrical, stout, densely flowered, 3–4 inches long. Pistillate aments linear-cylindrical, sparsely flowered, 2½–3¼ inches long. Stamens 40–60, with short, slender filaments and dark red anthers, inserted on a broad, shallow, oblique disk. Pistil solitary, enclosed at the base by the cup-shaped, shallow disk, consisting of a subglobose ovary and 3–4 nearly sessile, spreading, lobed stigmas.

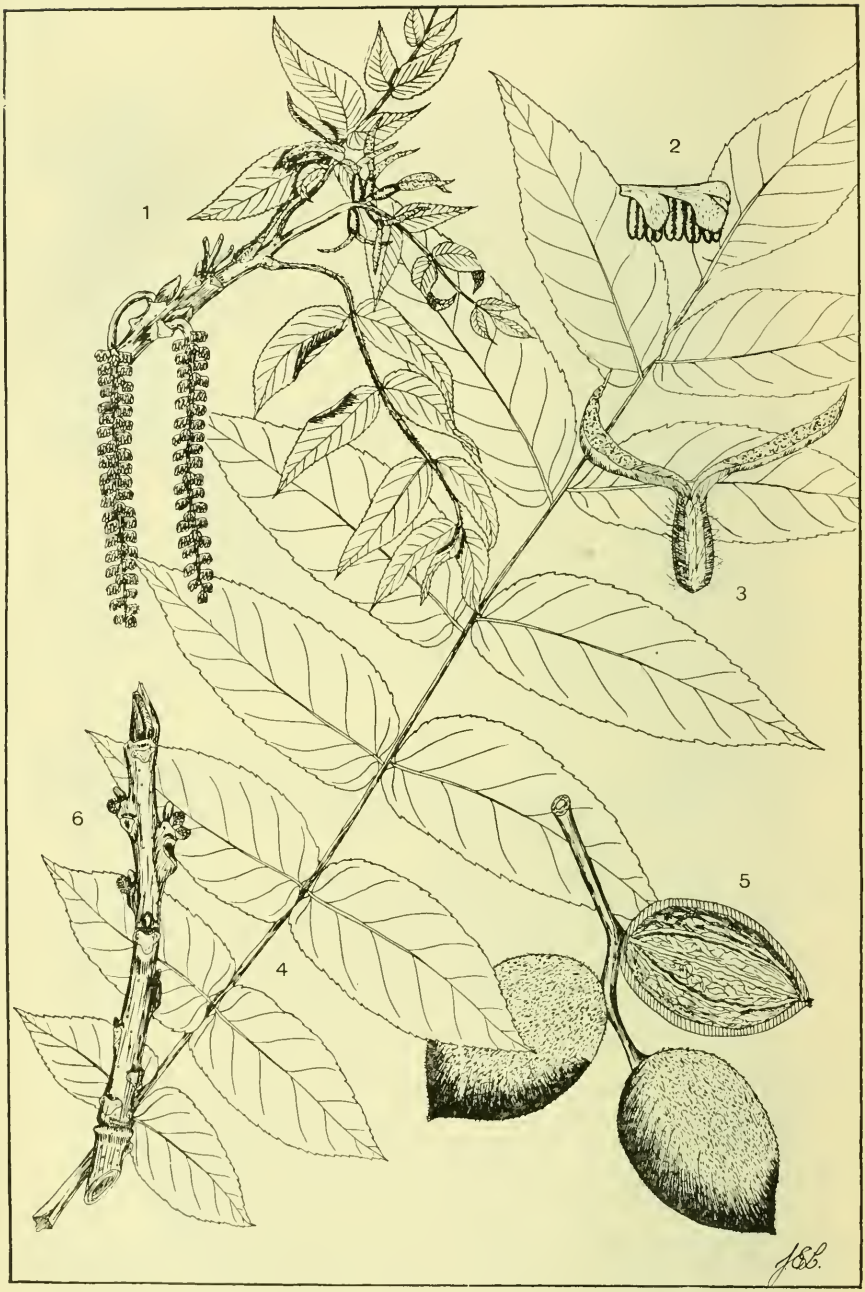
Fruit — An oblong-ovoid, acute, pedicellate, dark green capsule, thin-walled and glabrous at maturity, ¼–½ of an inch long. The capsules are borne loosely in naked, pendant, thin-stemmed aments 8–12 inches long, and open in May or early June by 3–4 valves to set free the minute, pale brown, white- or rusty-comose seeds.

Winter characters — Twigs stout, lenticellate, terete or angled below the buds, smooth, sometwhat lustrous, pale yellow tinged with green. Flower- and leaf-buds distinct. Leaf-buds ovate, acute, somewhat divergent, smooth, lustrous, chestnut-brown, covered by 6–7 scales which are water-proofed on their inner surface with a yellow, fragrant resin, ½–¾ of an inch long. Flower-buds similar until they begin to swell in early spring. Mature bark ashy gray, thick, deeply fissured with broad, rounded ridges. Younger bark pale yellowish green, thin and smooth.

Habitat — A moisture-loving, rapidly growing species preferring rich, damp soils along stream courses, borders of lakes and on wet meadows and bottom-lands. A form of this species, the Carolina Poplar, is widely planted as a shade tree along streets, in dooryards, etc.

Range — Southern Quebec west through southern Canada to the Rocky Mountains, south to Florida and New Mexico. Zones A, **B**, and **C**.

Uses — Wood light, soft, weak, fine-grained, difficult to season, dark brown, with thick, nearly white sapwood. Used for pulp, packing cases, light fuel. A staminate form of this species, the Carolina Poplar, is extensively used as a street and park tree, especially where quick effects as in real estate developments are desired. The tree is not to be recommended because it is short-lived and sheds many branches during the autumnal rains. The roots cause trouble by penetrating and clogging drains and sewers.



Butternut, White Walnut

Juglans cinera L.

1. A flowering branch showing pistillate and staminate flowers x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 2½
4. A mature leaf x ⅛
5. A fruit cluster x ½
6. Winter twig x ½

JUGLANDACEAE

Juglans cinera L.

Butternut, White Walnut

Habit — Usually a medium sized tree 30–50 feet in height, with a short, stout trunk 1–2 feet in diameter which divides 15–20 feet above the ground into several stout, horizontally-spreading limbs. Crown broad, unsymmetrical, round-topped and rather open. Under optimum conditions the tree may attain a height of 100 feet with a tall, stout, straight bole which is free of branches for half its length.

Leaves — Alternate, odd-pinnately compound, 15–30 inches long, consisting of 11–17 sessile or nearly sessile leaflets arranged in pairs along a stout, pubescent petiole, the terminal leaflet long-stalked. Leaflets oblong-lanceolate, 3–4 inches long, 1½–2 inches wide, acute or acuminate at the apex, inequilateral and rounded at the base, finely serrate except at the base, at maturity thin, yellowish green and rugose above, pale and soft pubescent beneath.

Flowers — Appearing in May or early June when the leaves are about half grown, monoecious, the staminate in stout, unbranched, elongated aments on the growth of the preceding season, the pistillate in terminal, 6–8-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers about ¼ of an inch long, epaulet-shaped, consisting of a rusty-pubescent, acute bract bearing adaxially a 6-lobed, light yellowish green perianth subtending 8–12 nearly sessile stamens. Anthers dark brown. Pistillate flowers about ⅓ of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by a short style and 2 clavate, spreading, bright red stigmas nearly half an inch in length. The ovary is closely invested by glandular, coherent bracts and the calyx.

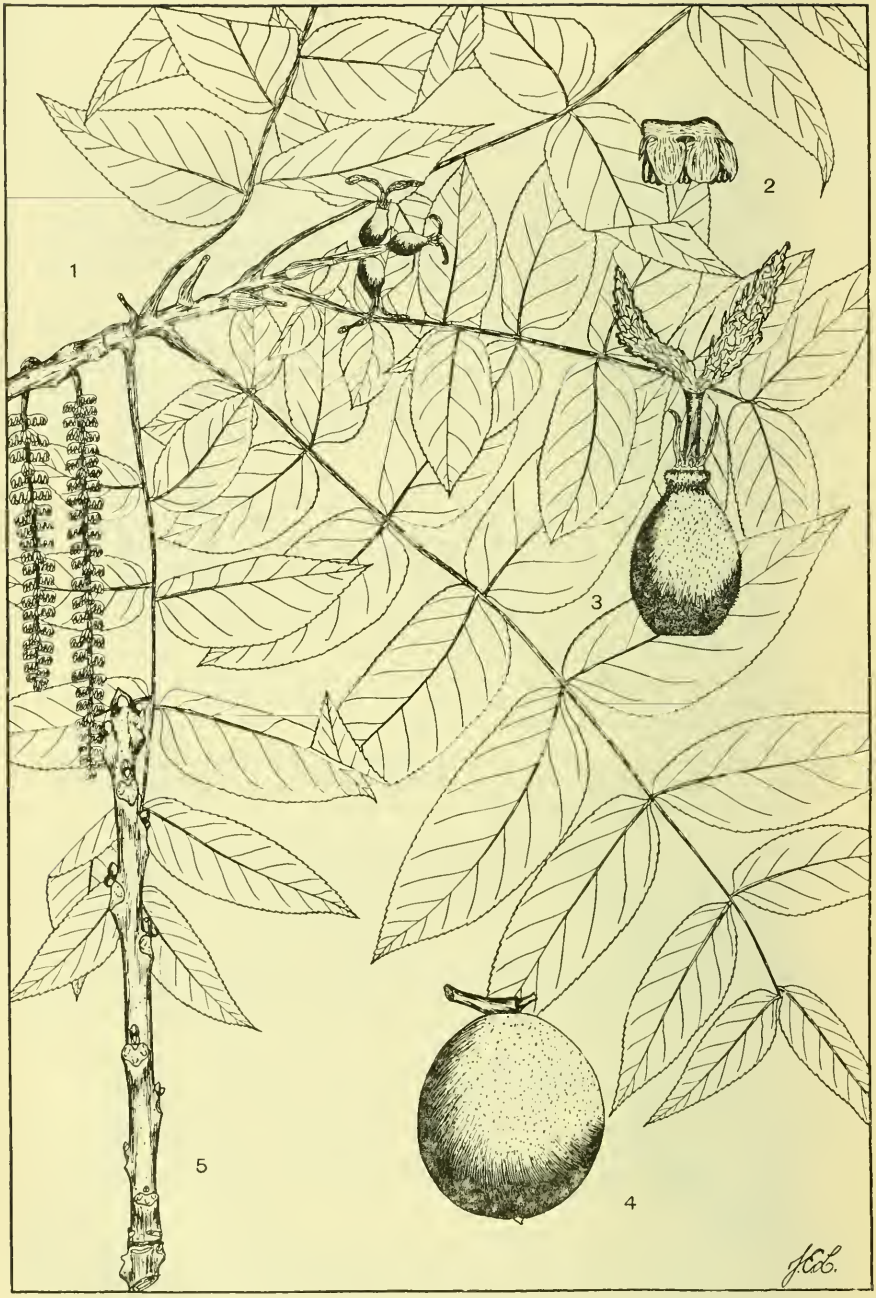
Fruit — An ovoid or ellipsoid, 4-ridged, sculptured nut, abruptly acute at the apex, 1-celled above, 2-celled at the base, covered by a glandular, hairy, indehiscent, fleshy, green husk.

Winter characters — Twigs stout, lenticellate, greenish gray to reddish buff and lustrous the first winter, turning reddish or orange-brown the second season, at length gray. Pith dark brown, diaphragmed. Leaf-scars elevated, obcordate, hairy fringed on the upper margin, with 3 equidistant U-shaped clusters of bundle-scars. Terminal buds truncate, ½–⅔ of an inch long, the outer scales lobed. Lateral buds smaller, ovate, blunt, often superposed. Staminate catkins preformed the preceding season, appearing as scaly, cone-like, lateral buds. Mature bark light gray, ¾–1 inch thick, divided by deep fissures into broad ridges scaly on the surface.

Habitat — Prefers rich, moist soils. Frequent along fences and roads, stream courses, in pastures and low moist woods, or on rocky hills.

Range — New Brunswick and Quebec through Ontario, Maine to Minnesota, south to Delaware, northern Georgia, and northeastern Arkansas. Common in the lowland forests of the northeast, rare south of the Ohio basin. Zones A, B, and C.

Uses — Not an important timber species. Wood light, soft, weak, rather coarse-grained, easily worked and polished, light brown darkening with exposure, with thin, light sapwood. Used occasionally for interior and cabinet work. The oily and nutritious nuts could no doubt be greatly improved by selection. The bark and husk of the nuts contain a yellow dye.



Black Walnut

Juglans nigra L.

1. A branch showing nearly mature leaves, and pistillate and staminate flowers x ½
2. A staminate flower, lateral view x 3
3. A pistillate flower, lateral view x 4
4. Globose fruit x ½
5. Winter twig x ½

JUGLANDACEAE

Juglans nigra L.

Black Walnut

Habit — A large tree 75–100 feet in height with a trunk diameter of 2–3 feet, in the rich alluvial soils of the Ohio basin sometimes attaining a height of 150 feet with a bole 5–6 feet in diameter. The trunk is straight and continuous into the crown, gradually breaking up into stout, spreading limbs which form a narrow or broad, round-topped crown. In tall individuals the bole is often clear of branches for 50–60 feet.

Leaves — Alternate, odd-pinnately compound, 1–2 feet long consisting of 13–23 sessile or nearly sessile leaflets arranged in pairs along a puberulent petiole, the terminal leaflet often suppressed. Leaflets ovate-lanceolate 3–3½ inches long, 1–1¼ inches wide, acuminate at the apex, rounded and usually inequilateral at the base, sharply serrate except at the base, at maturity thin, yellowish green, lustrous and glabrous above, soft pubescent beneath.

Flowers — Appearing in May and early June when the leaves are about half grown, monoecious, the staminate in stout, unbranched catkins, 3–5 inches in length on the growth of the preceding season, the pistillate in terminal 2–5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers about ¼ of an inch long, epaulet-shaped, consisting of a nearly triangular, rusty-tomentose bract bearing adaxially a rounded, 6-lobed perianth subtending 20–30 nearly sessile stamens. Anthers purple. Pistillate flowers about ¼ of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by a style and 2 clavate, ascending stigmas which are yellowish green tinged with red and ½–¾ of an inch long. The ovary is closely invested by glandular, cohering bracts and the calyx.

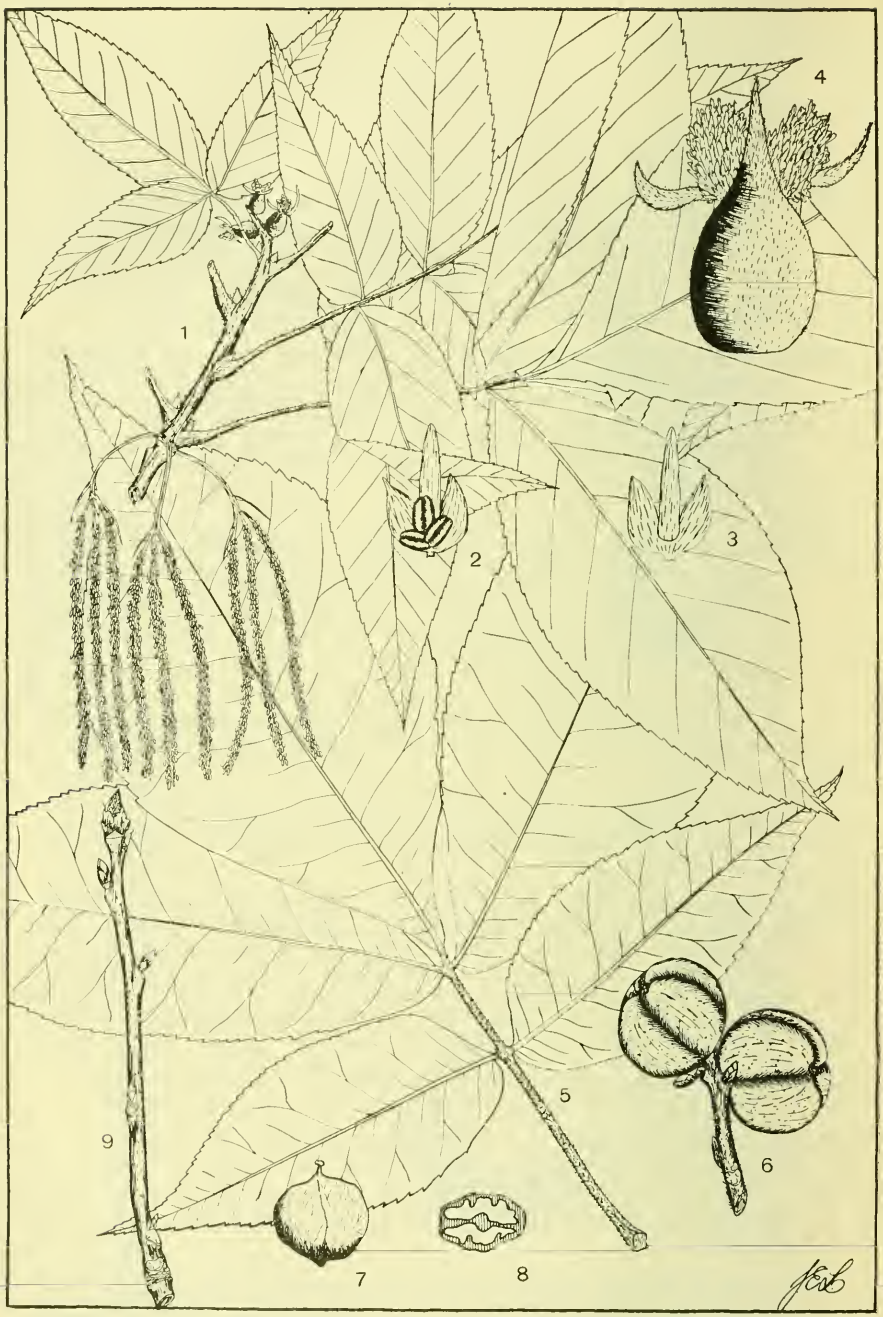
Fruit — A globose or oblong, deeply sculptured nut, 4-celled at the base, slightly 2-celled at the apex, 1¼–1½ inches in diameter, covered by a rather thick, indehiscent, yellowish green husk which is roughened with clusters of pale hairs.

Winter characters — Twigs stout, lenticellate, dull orange-brown and pilose the first winter, gradually darkening to a light brown. Pith pale buff, diaphragmed. Leaf-scars elevated, 3-lobed, often cordate, with 3 equidistant U-shaped clusters of bundle-scars. Buds pale grayish white. Terminal bud rounded, ovate, ⅛ of an inch long, covered by 4 scales, the outer pair rounded and lobed, the inner pinnatifid at the apex. Lateral buds smaller, blunt, often superposed. Staminate aments preformed the preceding season, appearing as scaly, cone-like, tomentose lateral buds. Mature bark dark brown to grayish black, 2–3 inches thick, divided by deep fissures into broad, rounded ridges, thick, scaly at the surface.

Habitat — Requires a deep, rich, moist, well-drained soil. Thrives best in the deep alluvial soils of bottom-lands and on fertile slopes.

Range — Central New England west through central New York, Michigan and Wisconsin, to Nebraska, south to Florida and eastern Texas. Zones A, B, and C.

Uses — One of the most valuable timber trees of eastern United States. Wood hard, heavy, strong, somewhat coarse-grained, easily worked, durable in contact with the soil, rich dark brown with thin pale sapwood. Prized for gun stocks, furniture, interior finish and cabinet making. Supply greatly depleted. Nut rich in oil, nutritious, often found in the eastern markets. Black Walnut is of decided ornamental value.



Shagbark Hickory, Shellbark Hickory

Carya ovata (Mill.) K. Koch. [*Hicoria ovata* (Mill.) Britt.; *Carya alba* Nutt.]

1. A branch showing immature leaves, and pistillate and staminate flowers x ½
2. A staminate flower, axile view x 5
3. A staminate flower, abaxile view x 5
4. A pistillate flower, lateral view x 6
5. A mature leaf x ½
6. A twig with fruit x ½
7. Nut x ½
8. Cross section of the nut x ½
9. Winter twig x ½

JUGLANDACEAE

Carya ovata (Mill.) K. Koch. [Hicoria ovata (Mill.) Britt; Carya alba Nutt.]

Shagbark Hickory, Shellbark Hickory

Habit — A tree at maturity attaining a height of 60–90 feet with a trunk diameter of 2–3 feet, under optimum conditions sometimes 120 feet tall. Crown in the open usually irregular and open, narrowly oblong-cylindrical, the bole usually forking low down into stout, ascending limbs. In the forest the bole is typically tall and columnar and often free of branches for 50–60 feet, bearing aloft a narrow head.

Leaves — Alternate, odd-pinnately compound, 8–14 inches long, consisting of 5–7 sessile or nearly sessile leaflets arranged in pairs along a stout, glabrous or pubescent, slightly grooved petiole, the lower pair the smallest and the terminal leaflet narrowed into a stalk. Leaflets ovate-lanceolate to obovate, 4–5 inches long, usually acuminate at the apex, inequilateral at the base, serrate and ciliate except near the base, at maturity thin, firm, dark yellowish green and glabrous above, pale, glabrous or puberulous below.

Flowers — Appearing in May and early June after the unfolding of the leaves, monoecious, the staminate in slender, light green, drooping catkins 4–5 inches long which are borne in pedunculate clusters of 3 on the growth of the preceding season, rarely at the base of the growth of the season, the pistillate in terminal, 2–5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers pedicellate, glandular-hirsute without, about ⅛ of an inch long, consisting of an elongated, ovate-lanceolate bract and 2 ovate, concave calyx-lobes bearing adaxially 3–4 stamens. Anthers nearly sessile, yellow, tinged with red. Pistillate flower about ⅛ of an inch long, sessile, consisting of an inferior 1-celled ovary surmounted by 2 sessile, spreading, pale green, papillate stigmas. The ovary is invested by the perianth-like, cohering, rusty-tomentose involucre.

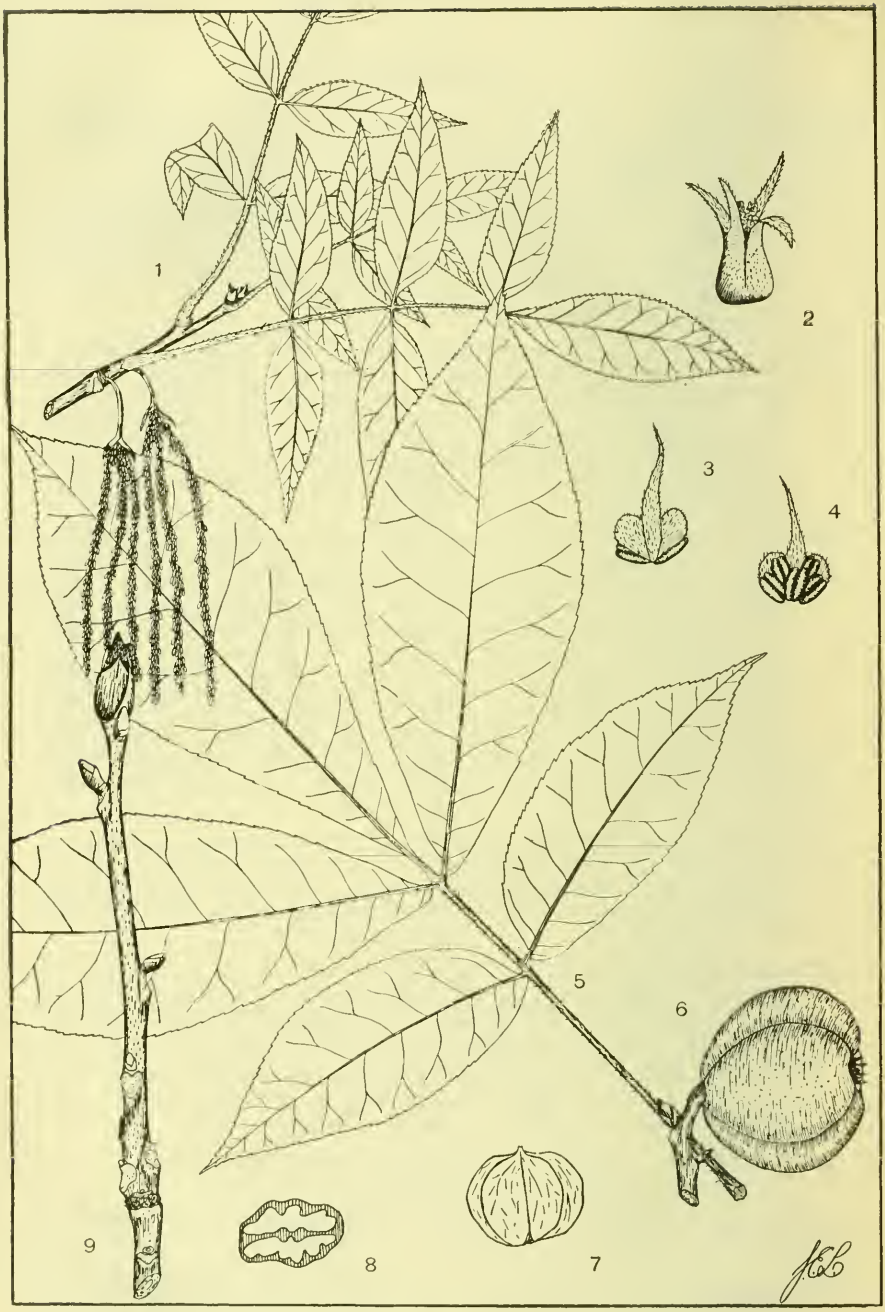
Fruit — Subglobose to obovate, 1–2½ inches long, 4-channeled from apex to base, at maturity dark reddish brown or nearly black, lenticellate, glabrous or pilose. Husk thick, splitting to the base. Nut white, thin-shelled usually oblong but very variable in form, 4 angled or ridged, with large, light brown, sweet kernel.

Winter characters — Twigs stout, lenticellate, usually somewhat pubescent or occasionally lustrous and smooth, reddish brown or grayish. Leaf-scars slightly elevated, inversely triangular to oblong, with scattered bundle-scars. Terminal bud broadly ovate, dark brown, ½–¾ of an inch long, the outer scales loose and pubescent on the outer surface and often keeled and projecting above into a point. Lateral buds smaller. Mature bark light gray, ¾–1 inch thick, separating into rough strips or plates which remain attached to the trunk, giving it a shaggy appearance.

Habitat — Prefers deep, moist soil. Common and of its largest size on the rich alluvial soils of the lower Ohio basin.

Range — Southern Quebec and Ontario, Maine to Minnesota, south to Florida and Texas. Zones **B** and C.

Uses — One of the most valuable hickories, producing excellent hickory stock. Wood heavy, very hard and strong, tough, elastic, close-grained, light brown with pale nearly white sapwood. Largely used in the manufacture of wagons, automobile wheels, axe helves, agricultural implements, etc. This tree produces the common hickory nut of commerce.



Big Shellbark, Kingnut

Carya laciniosa (Michx. f.) Laud. [Hicoria laciniosa Sarg.; Carya sulcata Nutt.]

1. A branch showing immature leaves, and pistillate and staminate flowers x ½
2. A pistillate flower, lateral view x 2½
3. A staminate flower, abaxile view x 3
4. A staminate flower, axile view x 2
5. A mature leaf x ½
6. A twig with fruit x ½
7. Nut x ½
8. Cross section of the nut x ½
9. Winter twig x ¼

JUGLANDACEAE

Carya laciniosa (Michx. f.) Laud. [Hicoria laciniosa Sarg.; Carya sulcata Nutt.]

Big Shellbark, Kingnut

Habit — Similar in gross features to the Shagbark Hickory. A tree 50–90 feet in height with a trunk diameter of 2–3 feet, occasionally 120 feet tall. Crown narrowly oblong to subovoid, consisting of rather short lateral branches, which extend in the open to within 8–10 feet of the ground. Lower branches pendulous. Under forest conditions the bole is tall, straight, and columnar and often free of branches for half its length, bearing aloft a reduced crown.

Leaves — Alternate, odd pinnately compound, 15–22 inches long, usually consisting of 7 (5–9) sessile or nearly sessile leaflets arranged in pairs along a stout, glabrous or pubescent, flattened, grooved petiole, the lower pairs the smaller and the terminal leaflet narrowed into a stalk. Leaflets ovate to oblong-lanceolate, the 3 upper usually obovate, 4–9 inches long, acuminate at the apex, rounded and inequilateral at the base, ciliate and finely serrate except near the base, at maturity thin, firm, dark green and somewhat lustrous above, paler and soft pubescent below.

Flowers — Appearing in May and early June after the unfolding of the leaves, monoecious, the staminate in slender, light green, drooping catkins 5–8 inches long which are borne in pedunculate clusters of 3 on the growth of the preceding season, rarely at the base of the growth of the season, the pistillate in terminal, 2–5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers pedicellate, rufous-tomentose without, about ⅛ of an inch long, consisting of a linear-lanceolate, acute bract and 2 rounded calyx-lobes bearing adaxially 3–5 stamens. Anthers yellow, nearly sessile. Pistillate flowers about ⅛ of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by 2 sessile, spreading, pale green, papillate stigmas. The ovary is invested by the perianth-like, cohering, pale tomentose involucre.

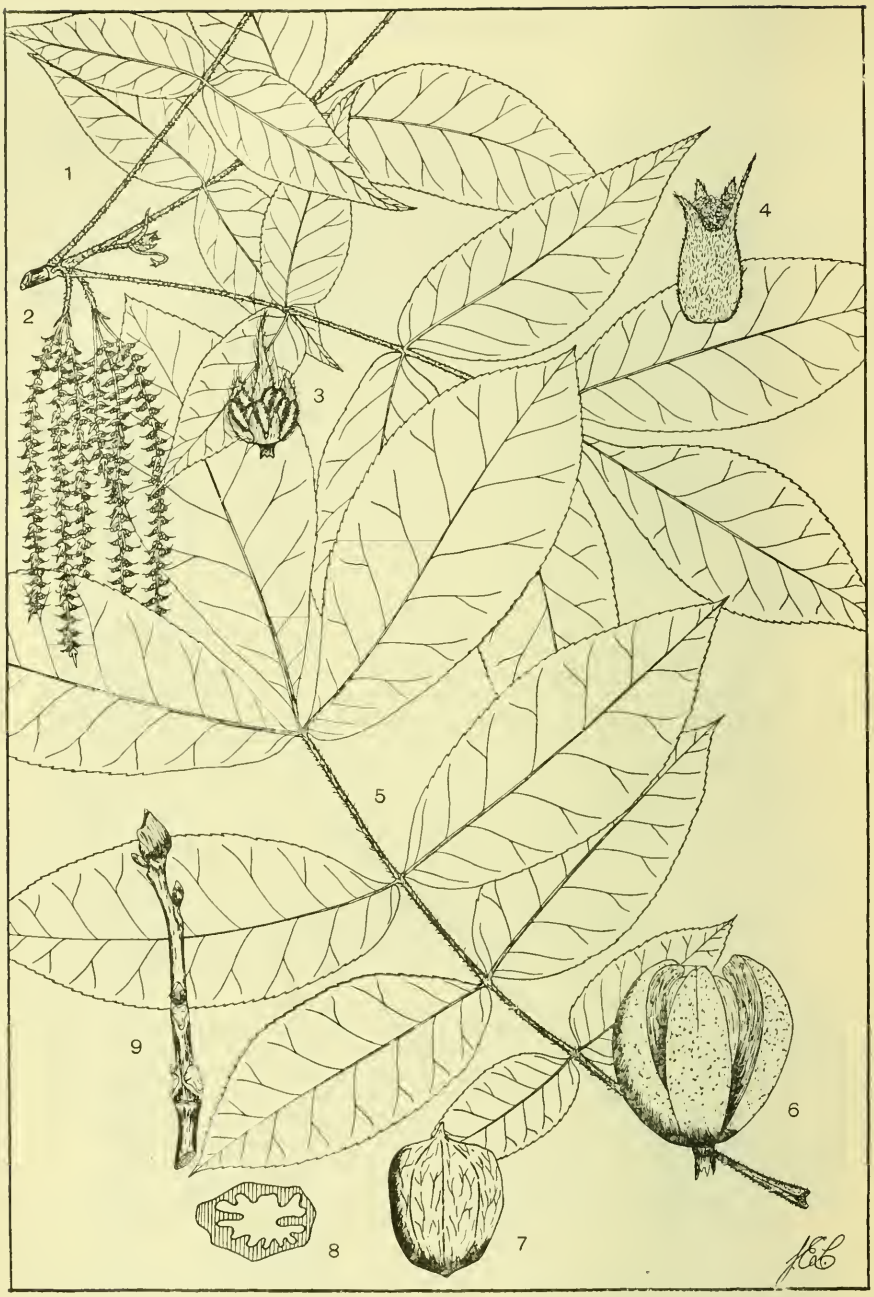
Fruit — Ellipsoid, ovoid, or subglobose, 1¾–2½ inches long, 4-channeled at least above the middle, at maturity light orange to pale chestnut-brown, glabrous or pubescent, orange-lenticellate. Husk thick, splitting to the base. Nut dull white or yellowish, thick-shelled, usually ellipsoidal but very variable, 4-ridged or angled, with large, light brown, sweet kernel.

Winter characters — Twigs stout, orange-lenticellate, usually somewhat pubescent, orange-brown turning to ashy gray the second winter. Leaf-scars slightly elevated, inversely triangular, the upper margin indented. Terminal bud ovate, dark brown, ¾–1 inch long, the outer scales rather loose and pubescent on the outer surface and often keeled and long pointed at the apex. Lateral buds much smaller. Mature bark light gray, 1–2 inches thick, separating into broad, thick plates which persist on the tree for a number of years giving the trunk a shaggy appearance.

Habitat — Distinctly a bottom-land tree, preferring wet but rich soils which are often inundated for several months in the spring. Occasional on fertile uplands.

Range — Central New York and Pennsylvania, west to eastern Nebraska, south to Tennessee, northern Arkansas and Oklahoma. Zone B.

Uses — Among the most valuable of the hickories as a source of timber. Wood similar to that of Shagbark Hickory and usually not distinguished in the trade. Nuts often found in the eastern markets, larger than those of the Shagbark but not as finely flavored.



Mockernut

Carya alba (L.) K. Koch. [Hicoria alba Britt.; Carya tomentosa Nutt.]

1. A branch showing immature leaves, and pistillate and staminate flowers x ½
2. Pedunculate clusters of staminate aments x ½
3. A staminate flower, axile view x 5
4. A pistillate flower, lateral view x 6
5. A mature leaf x ½
6. A fruit x ½
7. Nut x ½
8. Cross section of the nut x ½
9. Winter twig x ½

JUGLANDACEAE

Carya alba (L.) K. Koch. [Hicoria alba Britt.; Carya tomentosa Nutt.]

Mockernut

Habit — A tree usually 50–80 feet in height with a trunk diameter of 2–3 feet, under optimum conditions sometimes 100 feet tall. In the forest the crown is narrowly oblong and reduced, extending down about half way on the clean, straight bole. Trees in the open usually develop a broad, open, rather ragged crown.

Leaves — Alternate, very fragrant, odd-pinnately compound, 8–12 inches long, consisting of 7–9 sessile or nearly sessile leaflets arranged in pairs along a rather stout, pubescent, flattened, grooved petiole, the lower pairs gradually reduced in size and the terminal leaflet narrowed into a stalk. Leaflets oblong-lanceolate or obovate-oblanceolate, acuminate at the apex, somewhat rounded and inequilateral at the base, serrate, at maturity rather thin, dark green and lustrous above, pale orange-brown and pubescent below.

Flowers — Appearing in May and early June when the leaves are about half grown, monoecious, the staminate in slender, yellowish green drooping catkins 4–5 inches in length which are borne in pedunculate clusters of 3 on the growth of the preceding season or rarely at the base of the growth of the season, the pistillate in terminal, 2–5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers short pedicellate, pale yellowish green, 1/16–⅛ of an inch long, consisting of an ovate-lanceolate bract and 2 rounded calyx-lobes bearing adaxially 4 stamens. Anthers bright red and nearly sessile. Pistillate flowers about ⅛ of an inch long, sessile, consisting of an inferior 1-celled ovary surmounted by 2 sessile, spreading, dark red stigmas. The ovary is invested by the greenish, tomentose, perianth-like involucre.

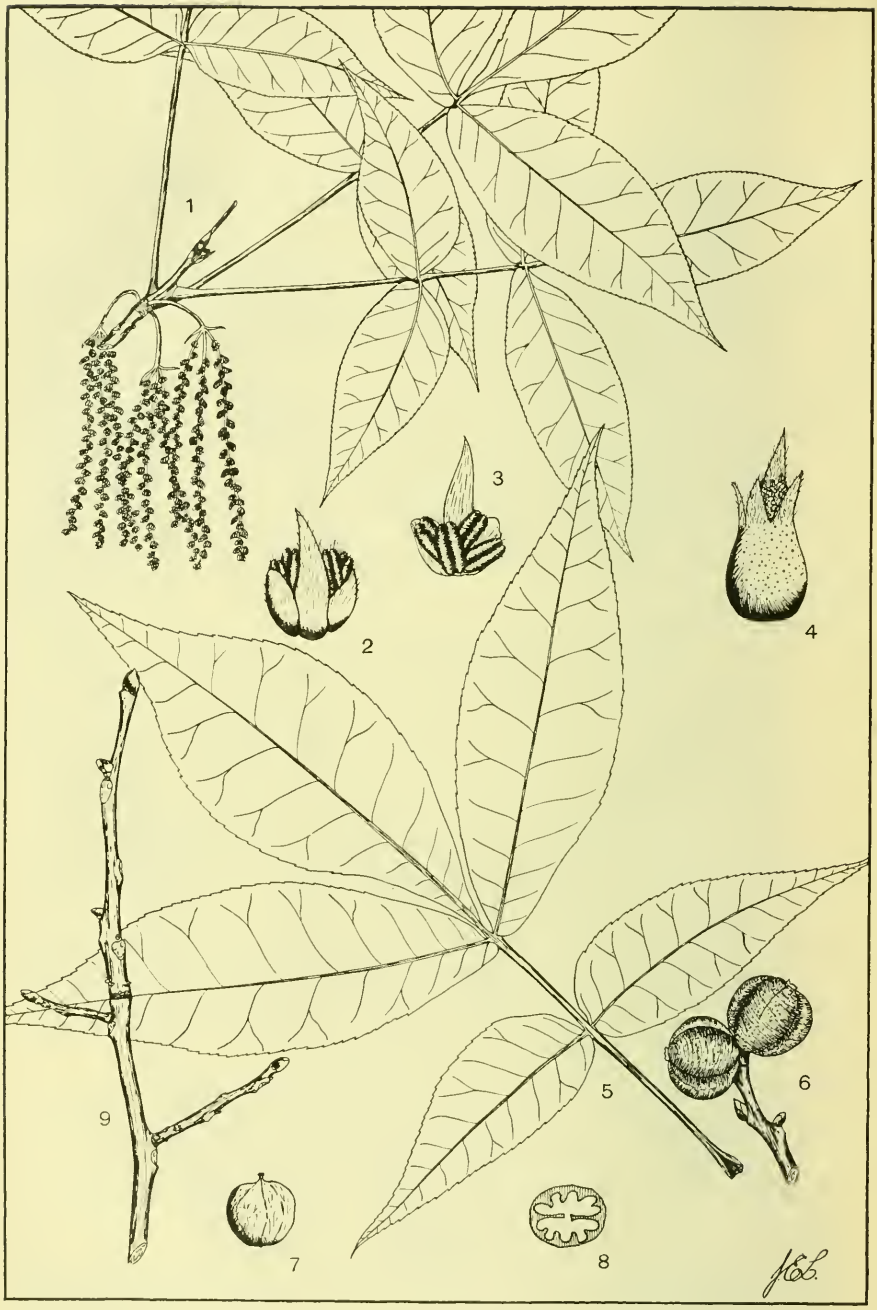
Fruit — Ellipsoidal to obovate, 1½–2 inches in length, 4-channeled from apex to base, at maturity dark reddish brown, lenticellate, nearly glabrous. Husk thick, splitting to the base. Nut pale reddish brown, very thick-shelled, globose to ellipsoidal but very variable in shape, 4-ridged toward the apex, with small, dark brown, sweet kernel.

Winter characters — Twigs very stout, pale-lenticellate, pubescent, reddish brown turning gray the second season. Leaf-scars inversely 3-lobed, the bundle-scars in marginal clusters. Terminal bud reddish brown or yellowish, usually tomentose, ½–¾ of an inch long. Lateral buds much smaller. Mature bark gray, rather thin, shallowly fissured, close-scaly.

Habitat — A moisture-loving tree preferring rich, deep-soiled bottom-land woods, more rarely on fertile slopes and hills.

Range — Massachusetts west through central New York and southern Ontario to eastern Kansas, south to Florida and Texas. Zones A and B.

Uses — Produces the best grade of hickory stock. Wood hard, strong, heavy, tough and elastic, dark brown with thick sapwood. Used similarly as the wood of the other hickories. Nuts occasionally found in the eastern markets.



Small-fruited Hickory

Carya microcarpa Nutt. [Hicoria microcarpa (Nutt.) Britt.; Hicoria glabra, var. odorata Sarg.]

1. A branch showing immature leaves, and pistillate and staminate flowers x ½
2. A staminate flower, abaxile view x 5
3. A staminate flower, axile view x 5
4. A pistillate flower, lateral view x 5
5. A mature leaf x ½
6. A twig-tip with fruit x ½
7. Nut x ½
8. Cross section of nut x ½
9. Winter twig x ½

JUGLANDACEAE

Carya microcarpa Nutt. [Hicoria microcarpa (Nutt.) Britt.; Hicoria glabra, var. odorata Sarg.]

Small-fruited Hickory

Habit — A tree at maturity attaining a height of 50–80 feet with a trunk diameter of 2–3 feet, under optimum conditions sometimes 100 feet tall. Crown narrowly oblong with rather short, spreading branches, the lower mostly pendulous. Bole continuous into the crown, sometimes forked.

Leaves — Alternate, odd-pinnately compound, 8–12 inches long, consisting of 5–7 sessile or nearly sessile leaflets arranged in pairs along a stout, smooth, slightly grooved petiole, the terminal leaflet narrowed into a stalk. Leaflets ovate-lanceolate to oblong, 3–5 inches long, 1–2 inches broad, acuminate at the apex, rounded and usually inequilateral at the base, sharply serrate except at the base, at maturity thick, firm, dark yellowish green and shining above, paler and glabrous below.

Flowers — Appearing in May and June after the unfolding of the leaves, monoecious, the staminate in slender drooping catkins 3–6 inches long which are borne in pedunculate clusters of 3 on the growth of the preceding season or rarely at the base of the growth of the season, the pistillate in terminal 2–5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flower short-pedicellate, somewhat pubescent, about ⅛ of an inch long, consisting of an ovate-lanceolate bract and two calyx-lobes bearing adaxilly 4 stamens. Pistillate flowers about ¾ of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by 2 sessile, spreading, yellowish green stigmas. The ovary is invested by the cohering, pale green involucre.

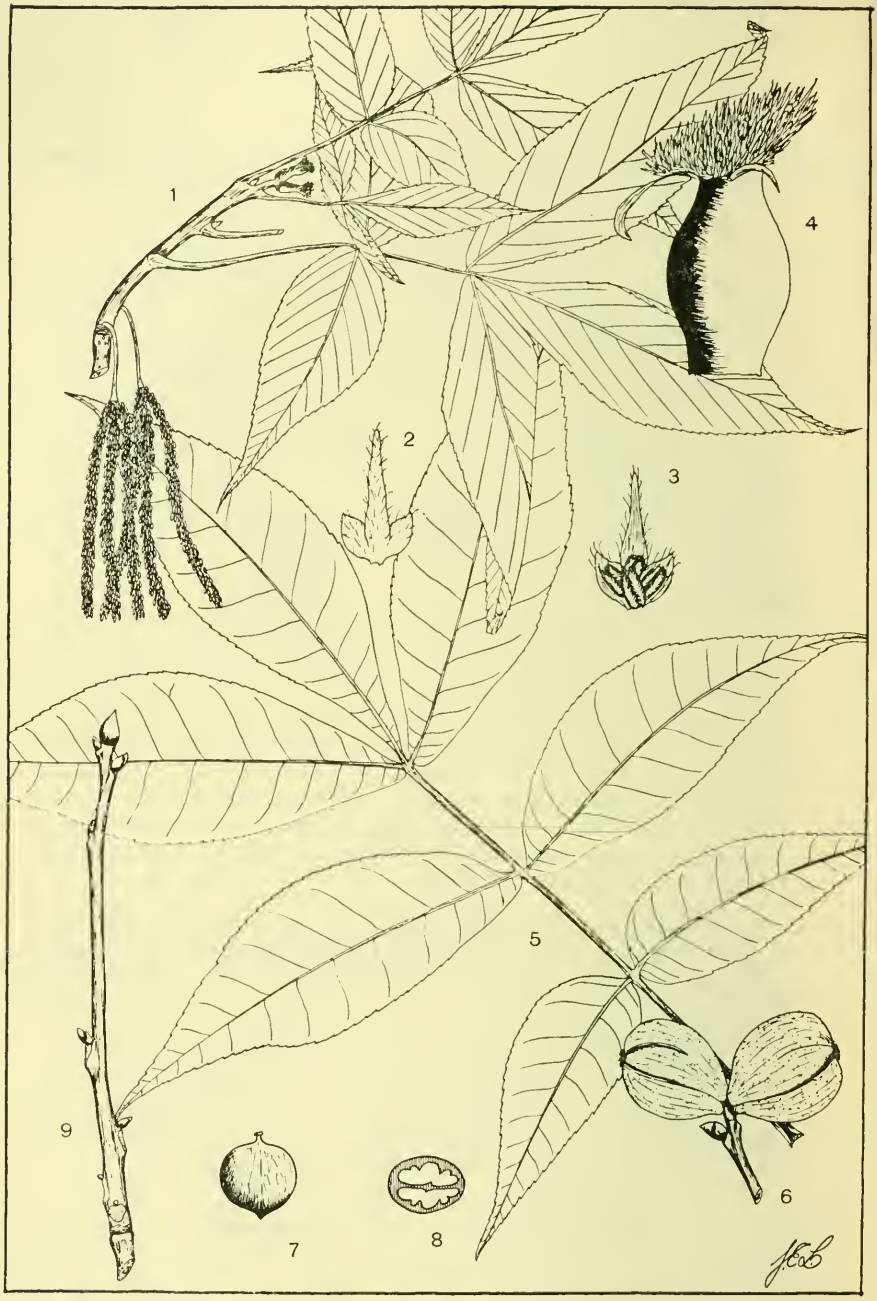
Fruit — Subglobose, ⅘–1 inch long, 4-channeled from apex to base, light brown and scaly at maturity. Husk thin, tardily splitting. Nut brownish white, thin-shelled, subglobose and often slightly angled, with small, sweet kernel.

Winter characters — Twigs rather slender, pale-lenticellate, smooth and lustrous, light brown turning dark red the second season. Leaf-scars bluntly and inversely triangular, the bundle-scars in clusters in the lobes. Terminal bud reddish brown and lustrous, ovoid, ¼–⅜ of an inch long, the scales imbricated and close-fitting. Mature bark thin, at first close and shallowly furrowed, at length shaggy with thin plates.

Habitat — An upland species preferring the same sites as the Pignut Hickory and usually not distinguished from this species.

Range — Central New England west through New York, southern Ontario and Michigan to Iowa, south to Georgia and Missouri. Zones A, **B**, and C.

Uses — Wood similar to that of the Pignut Hickory and put to similar uses. Nuts sweet but too small for general commercial exploitation.



Pignut

Carya glabra (Mill.) Spach. [Hicoria glabra Britt.; Carya porcina Nutt.]

1. A branch showing immature leaves, and pistillate and staminate flowers x ½
2. A staminate flower, abaxile view x 5
3. A staminate flower, axile view x 5
4. A pistillate flower, lateral view x 6
5. A mature leaf x ½
6. A twig-tip with fruit x ½
7. Nut x ½
8. Cross section of nut x ½
9. Winter twig x ½

JUGLANDACEAE

Carya glabra (Mill.) Spach. [Hicoria glabra Britt.; Carya porcina Nutt.]

Pignut

Habit — A tree at maturity attaining a height of 80–90 feet with a trunk diameter of 2–3 feet, occasionally 120 feet in height. Crown oblong, rather narrow, consisting of short, spreading branches, the lower somewhat pendulous. Bole tall, slender, tapering, often free of lateral branches for some distance, occasionally forked.

Leaves — Alternate, odd-pinnately compound, 8–12 inches long, consisting of 5–7 (rarely 9) sessile leaflets arranged in pairs along a slender, glabrous or pubescent, slightly grooved petiole, the terminal leaflet narrowed into a stalk. Leaflets lanceolate to obovate-oblanceolate, 3–8 inches long, 1–2½ inches broad, acuminate at the apex, rounded and usually inequilateral at the base, sharply serrate except at the base, at maturity thick, firm, dark yellowish green and glabrous above, paler, glabrous or with axillary tufts of hairs below.

Flowers — Appearing in May and June after the unfolding of the leaves, monoecious, the staminate in slender drooping catkins 3–7 inches long which are borne in pedunculate clusters of 3 on the growth of the preceding season or rarely at the base of the growth of the season, the pistillate in terminal, 2–5-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers short pedicellate, pale tomentose, about ¼ of an inch long, consisting of an ovate or lanceolate bract and 2 calyx-lobes bearing adaxilly 4 stamens. Anthers nearly sessile, orange-colored. Pistillate flowers about ¼ of an inch long, sessile, consisting of an inferior, 1-celled ovary surmounted by 2 sessile, spreading yellow stigmas. The ovary is invested by the cohering, glabrous or pubescent, pale green involucre.

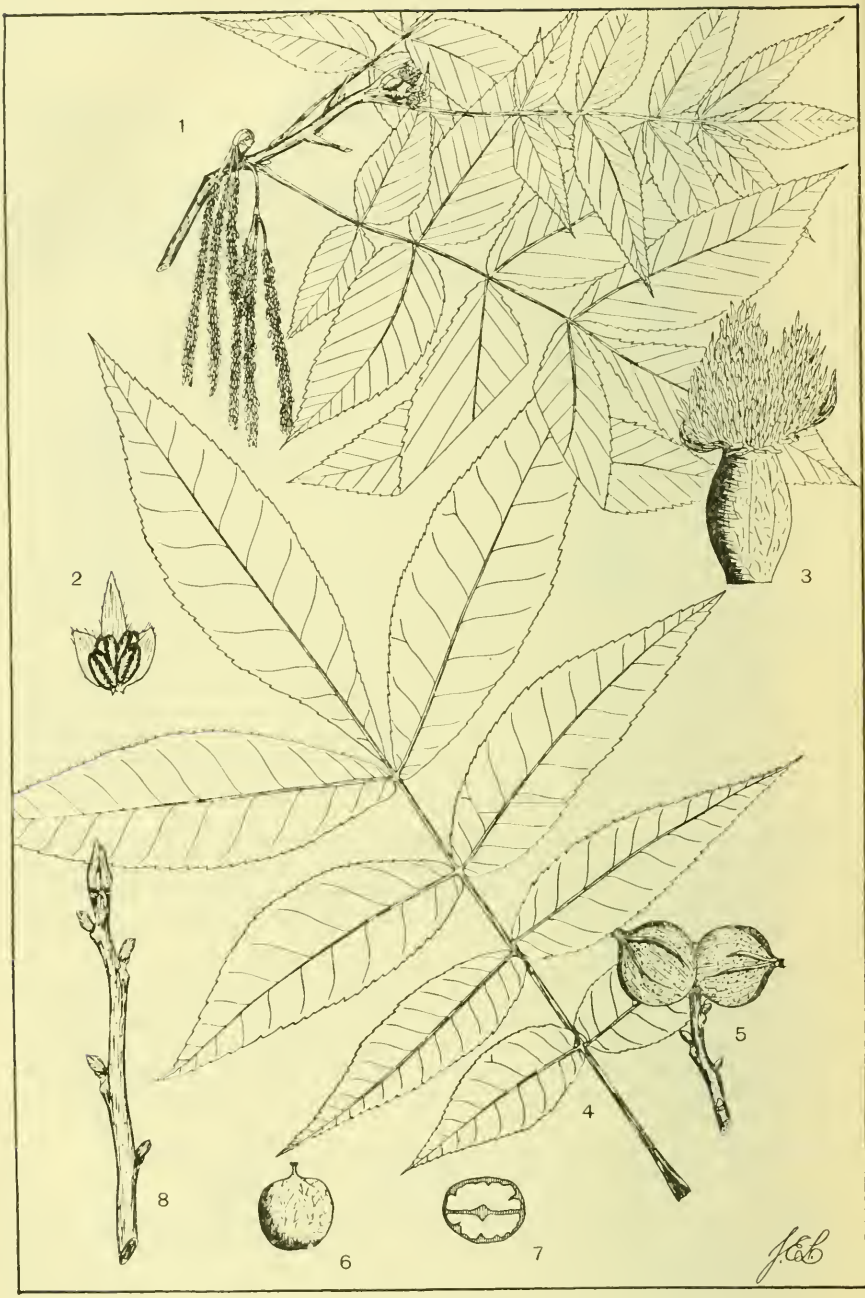
Fruit — Pyriform or globose, 1½–2 inches long, 4-sutured at least above the middle, at maturity reddish brown and often pubescent. Husk thin, often opening rather tardily at the apex, sometimes enclosing the nut after it has fallen. Nut brownish white, thick-shelled, ellipsoidal to subglobose with light brown, bitter kernel.

Winter characters — Twigs rather slender, pale-lenticellate, smooth and lustrous, light reddish brown turning dark red the second season. Leaf-scars bluntly and inversely triangular, slightly indented above, rather small. Terminal bud reddish brown and lustrous, ellipsoidal, ¼–½ of an inch long, the scales rather close-fitting. Lateral buds much smaller. Mature bark thin, close, light gray with shallow fissures separating narrow ridges, never shaggy.

Habitat — An upland species preferring dry ridges and hillsides, often in admixture with Oak and Chestnut.

Range — New England west through southern Ontario and Michigan to southern Minnesota and Nebraska, south to Florida and eastern Texas. Zones A, **B**, and C.

Uses — Produces a valuable grade of hickory timber. Wood heavy, hard, very strong, tough, elastic, close-grained. Used similarly as the wood of the other hickories for wheels, tool handles, etc. Nuts very variable in flavor.



Bitternut

Carya cordiformis (Wang.) K. Koch. [Hicoria minima (Marsh.) Britt.; Carya amara Nutt.]

1. A branch showing immature leaves, and pistillate and staminate flowers x ½
2. A staminate flower, axile view x 5
3. A pistillate flower, lateral view x 7½
4. A mature leaf x ½
5. A twig-tip with fruit x ½
6. Nut x ½
7. Cross section of the nut x ½
8. Winter twig x ½

JUGLANDACEAE

Carya cordiformis (Wang.) K. Koch. [Hicoria minima (Marsh.) Britt.; Carya amara Nutt.]

Bitternut

Habit — A tree 40–75 feet in height with a trunk diameter of 1–2½ feet, under optimum conditions in the southern part of its range sometimes attaining a height of 100 feet with a tall, straight, clean trunk. Crown round-topped, broadest near the top, consisting of rather slender, stiff, upright, ascending branches, under forest conditions usually much restricted in size.

Leaves — Alternate, odd-pinnately compound, 6–10 inches long, consisting of 5–9 sessile leaflets arranged in pairs along a slender, pubescent, slightly grooved petiole, the terminal leaflet narrowed into a stalk. Leaflets lanceolate to ovate-lanceolate, 4–6 inches long, ¾–1¼ inches wide, acuminate at the apex, rounded or subcordate and usually inequilateral at the base, rather coarsely serrate except at the base, at maturity thin, firm, dark yellowish green and glabrous above, paler, often yellow glandular and glabrous or somewhat pubescent below.

Flowers — Appearing in May or early June after the unfolding of the leaves, monoecious, the staminate in slender, drooping catkins 3–4 inches long which are borne in clusters of 3 on the growth of the preceding season or rarely at the base of the growth of the season, the pistillate in terminal, 2–10-flowered spikes capping the growth of the season, the two sorts proximal. Staminate flowers short pedicellate, somewhat pubescent, about 1/10 of an inch long, consisting of a rufous, ovate, acute bract and 2 calyx-lobes of the same color bearing adaxially 4 stamens. Anthers yellow, ovate, short-stalked. Pistillate flowers about ½ an inch long, sessile, consisting of an inferior 1-celled ovary surmounted by 2 sessile, spreading, pale green stigmas, papillate on the stigmatic surface. The ovary is invested by a perianth-like, cohering, slightly 4-ridged, yellowish green involucre.

Fruit — Ovate or subglobose, ¾–1½ inches long, 4-winged along the sutures from the apex half way to the base, greenish yellow, scurfy and pubescent. Husk thin. Nut thin-shelled, as broad or broader than long, smooth, abruptly pointed, with reddish brown, very bitter kernel.

Winter characters — Twigs slender, lenticellate, glossy, often yellow glandular and hairy toward the apex but smooth below, grayish or orange-brown during the first winter, at length light gray. Pith brown, angular. Leaf-scars elevated, obcordate, with 3 groups of bundle-scars. Terminal bud yellow, oblique and blunt at the apex, ⅛–¾ of an inch long, consisting of 4 glandular scales valvate in pairs. Lateral buds smaller, somewhat 4-angled, superposed, ⅛–¾ of an inch long, the lowest or axillary bud sessile and sharp-pointed, the upper pedunculate and angular. Mature bark light gray, ⅛–¾ of an inch thick, close, with shallow fissures and narrow ridges, the surface peeling in small flakes.

Habitat — By preference a bottom-land tree growing on low, wet sites in pastures, fields, along sluggish streams, and in lowland deciduous forests. Occasionally found in hilly situations, on limestone outcroppings, and mountain slopes.

Range — Southern Quebec and Ontario, Maine to southern Minnesota, south into the Gulf States. Zones **B** and C.

Uses — A valuable timber species contributing a part of the hickory wood of commerce. Wood heavy, hard, strong, tough, elastic, close-grained, dark brown with paler sapwood. Valued for wagon and automobile wheels, wagon tongues, whippletrees, tool handles, etc. Nuts bitter, not edible.

Hop Hornbeam, Ironwood, Leverwood

Ostrya virginiana (Mill.) K. Koch.

1. A twig showing pistillate and staminate aments x ½
2. A bract from staminate ament, abaxile view x 5
3. A staminate flower with bract, axile view x 5
4. A bract from pistillate ament, abaxile view x 6
5. Pistillate flowers with bract, axile view x 6
6. A twig showing mature leaves and fruit x ½
7. Vertical section of fruiting involucre showing enclosed nutlets x 2
8. Nutlet x 2½
9. Winter twig with staminate aments x ½

BETULACEAE

Ostrya virginiana (Mill.) K. Koch.

Hop Hornbeam, Ironwood, Leverwood

Habit — At maturity a small tree usually 25–40 feet in height with a short trunk 8–15 inches in diameter, occasionally seventy feet tall. Crown rather high, open, broad, round-topped, consisting of slender branches, the lower wide-spreading and often pendulous with fine, ascending branchlets.

Leaves — Alternate, borne on slender, terete petioles about ¼ of an inch long, ovate-oblong to ovate-lanceolate, 3–5 inches long, 1½–2 inches wide, acuminate or acute at the apex, rounded or slightly cordate and inequilateral at the base, finely doubly serrate, at maturity thin, coriaceous, smooth and dull yellowish green above, pale green below with tufts of pale hairs in the axils of the veins.

Flowers — Appearing in April or early May with the leaves, monoecious, borne in aments. Staminate aments, preformed the preceding season, clustered, subterminal, cylindrical, at anthesis reddish brown, pendant, about 2 inches long. Pistillate aments appearing with the leaves, terminal on the growth of the season, pedunculate, lax, pale green, ½–¾ of an inch long. The staminate flowers consist of 6–28 yellow half-anthers which are long-hairy at the apex and are raised on short, bifurcated filaments inserted on a pilose torus, the group subtended by a broadly ovate, concave scale. The pistillate flowers are borne in pairs at the base of an ovate acute bract which persists until mid-summer, and consist of an ovary closely invested by a hairy sac-like structure formed of a bracteole and 2 secondary bractlets, a short style, and 2 long, filiform, red stigmas.

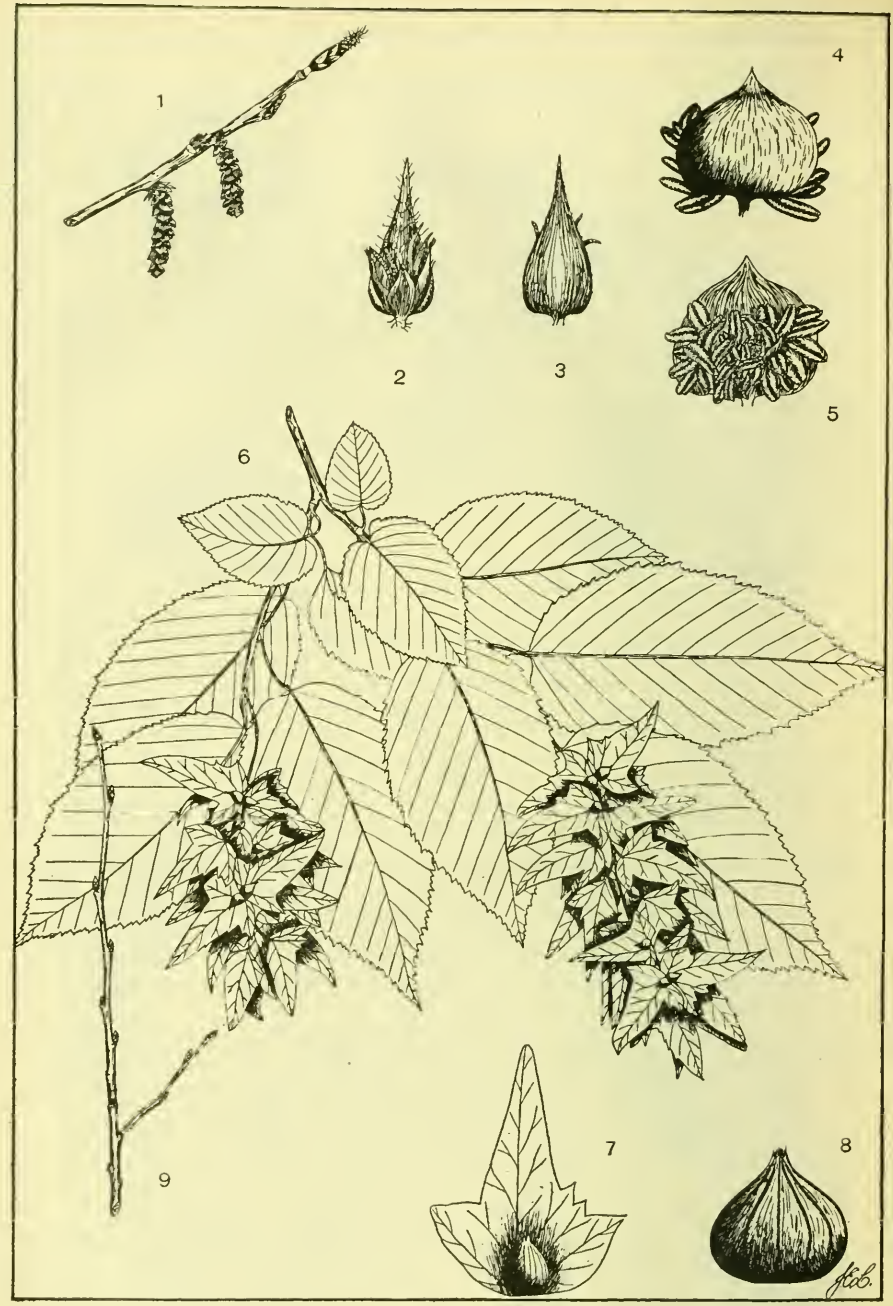
Fruit — A long-pedunculate, pendulous, creamy-white, oblong strobile, 1½–2½ inches long, ⅔–1 inch in width, consisting of ovate, acute, membranaceous, bladder-like, reticulate-venose, imbricated involucres forming a hop-like fruit. Fruiting involucre about ¾ of an inch long, slightly hairy at the apex, with sharp, stiff, stinging-hairs at the base, enclosing but much larger than the ovate, acute, flattened, chestnut-brown nutlet, at length deciduous from the strobile axis.

Winter characters — Twigs slender, tough, pale-lenticellate, smooth, lustrous, dark reddish brown and often zigzag, becoming dull and darker the second year. Terminal bud absent. Lateral buds ovate, acute, slightly puberulous, divergent, light chestnut-brown, about ¼ of an inch long. Mature bark light grayish brown, thin, consisting of narrowly oblong, thick scales which are loose at the ends and give a shreddy appearance to the bole.

Habitat — Dry gravelly and stony soils on slopes, ridges and limestone outcrops, rarely on moist sites. A tolerant species occurring in admixture with Beech, Hard Maple, Yellow Birch, White Ash, Elm, etc., seeding abundantly and forming the bulk of the under-growth in many places.

Range — Nova Scotia through southeastern Canada to Lake Superior, in the United States from Maine to Minnesota, South Dakota and Nebraska, southward to the Gulf. Zones B, **C**, and D.

Uses — Wood very heavy, hard, strong, tough, close-grained, light brown, reddish brown or nearly white, with thick, pale white sapwood. Not durable in contact with the soil. Used for tool handles, mallets, levers, fence posts and for fuel.



Blue Beech, Hornbeam, Water Beech

Carpinus caroliniana Walt.

1. A twig showing pistillate and staminate aments x ½
2. Pistillate flowers with bract, axile view x 4
3. A bract from pistillate ament, abaxile view x 4
4. A bract from staminate ament with stamens, abaxile view x 5
5. A staminate flower with bract, axile view x 5
6. A twig showing mature leaves and fruit x ½
7. Nutlet with trilobed subtending involucre x 1½
8. Involucre and nutlet, axile view x 5
9. Winter twig x ½

BETULACEAE

Carpinus caroliniana Walt.

Blue Beech, Hornbeam, Water Beech

Habit — A shrub or low bushy tree 25–30 feet in height with a short fluted trunk 6–12 inches in diameter, under optimum conditions sometimes 40 feet in height with a trunk 18–24 inches in diameter. Crown round-topped and wide-spreading, consisting of long, wiry, ascending branches which are often pendulous at the tips, and short, thin laterals, the two forming horizontal sprays.

Leaves — Alternate, borne on slender, terete, hairy petioles about ⅛ of an inch long, ovate-oblong, 2–4 inches long, 1–1¾ inches wide, acuminate at the apex, rounded or cuneate and often inequilateral at the base, finely doubly serrate, at maturity thin, firm, smooth and deep green above, pale green and glabrous or puberulous below with tufts of pale hairs in the axils of the veins.

Flowers — Appearing in April and early May with the leaves, monoecious, borne in aments. Staminate aments arising from lateral buds similar to leaf-buds but larger, at anthesis reddish green, pendant, about 1½ inches long. Pistillate aments appearing with the leaves, terminal on the growth of the season, lax, green, ½–¾ of an inch long. The staminate flowers consist of 6–40 yellow half-anthers which are raised on short, bifurcated filaments inserted on a pilose torus, the group subtended by a short-stalked, broadly ovate, concave scale. The pistillate flowers are borne in pairs at the base of an ovate, acute, deciduous bract and consist of an ovary invested by a bracteole and 2 secondary bractlets, a short style, and 2 elongated, filiform scarlet stigmas.

Fruit — A long-pedunculate, pendulous cluster of 3-lobed, foliaceous, green involucres, 1½–4 inches long, 1–2 inches wide, each involucre bearing adaxially a corrugated, light brown nutlet. The involucres arise from the fusion of a bracteole and 2 secondary bractlets and are borne vis-a-vis in pairs.

Winter characters — Twigs very slender, tough, pale-lenticellate, smooth, lustrous, dark reddish brown and often zizag, at length dull reddish gray. Terminal bud absent. Lateral buds ovate, acute, slightly puberulous, somewhat divergent, light chestnut-brown, about ⅛ of an inch long. Mature bark bluish gray tinged with brown, thin, forming a smooth layer on the fluted trunk.

Habitat — A moisture-loving species usually found in swamps, along the banks of streams, in low wet woods and on moist slopes.

Range — Nova Scotia westward through southern Canada to Minnesota, southward to Florida and Texas. Zones B and C.

Uses — Of no commercial significance. Wood very heavy, hard, strong, close-grained, light brown with thick white sapwood. The tree is occasionally used ornamentally on wet, springy sites.

Sweet Birch, Cherry Birch, Black Birch

Betula lenta L.

1. A twig showing pistillate and staminate aments x ½
2. Bract and bracteoles from staminate ament showing stamens, distal view x 3
3. Staminate flowers with subtending bracts, and sepals, axile view x 3
4. Bract and bracteoles from pistillate aments showing styles, abaxile view x 3
5. Pistillate flowers with subtending bracts, axile view x 3
6. A twig showing mature leaves and fruiting strobiles x ½
7. Scale from fruiting strobile, abaxile view x 3
8. Winged nutlet x 3
9. Winter twig x ½

BETULACEAE

Betula lenta L.

Sweet Birch, Cherry Birch, Black Birch

Habit — A tree under optimum conditions sometimes attaining a height of 75–80 feet with a trunk diameter of 3–4 feet, usually 50–60 feet tall. Crown at first rather narrowly conical, clothed with ascending branches which extend nearly to the ground, at length open, round-topped and rather narrow, with long, slender, horizontal or somewhat pendulous, much-forked branches. Bole in mature trees tapering.

Leaves — Alternate, ovate or oblong-ovate, 2½–5 inches long, 1½–3 inches wide, acute at the apex, slightly cordate or rounded and inequilateral at the base, sharply doubly serrate, at maturity membranaceous, smooth, dark dull green above, pale yellow-green and smooth below aside from the axillary tufts of white hairs, borne on stout, hairy petioles ¾–1 inch long.

Flowers — Appearing in April or early May before the leaves, monoecious, borne in aments. Staminate aments preformed the preceding season, clustered, subterminal, cylindrical, at anthesis brownish yellow, 3–4 inches long. Pistillate aments appearing as the buds unfold, terminal and solitary on short, 2-leaved lateral branches, pale green, cylindrical, sessile, ½–¾ of an inch long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short, bifurcated filaments and accompanied by a calyx of 1 sepal, the cluster of 3 covered distally by a peltate, obovate bract and 2 bracteoles. The pistillate flower consists of a small, green, ovoid ovary surmounted by 2 spreading, filiform, pink styles, the cluster of 3 subtended by an oblong, obtuse bract and 2 adnate bracteoles.

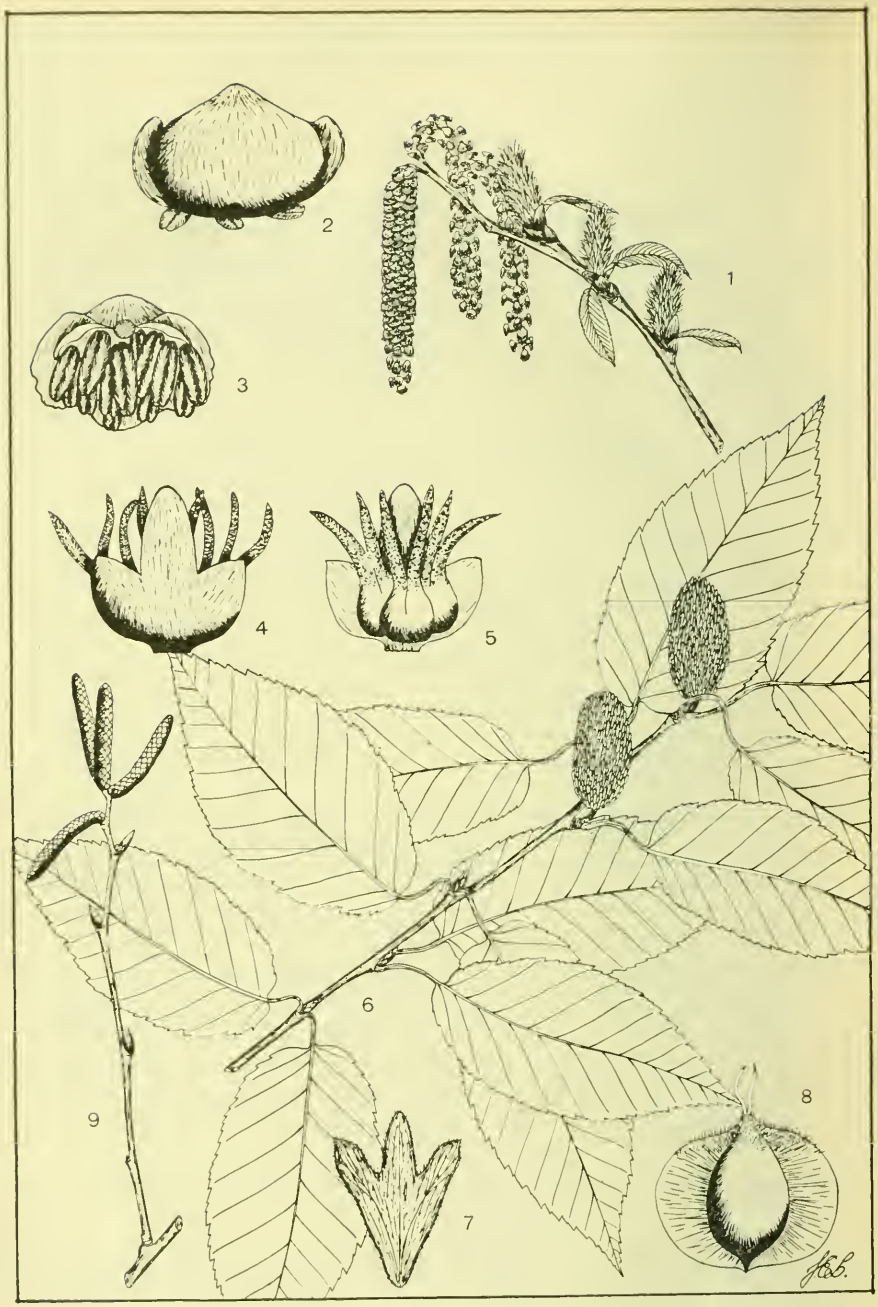
Fruit — A sessile, pale brown, short-cylindric, obtuse, woody strobile 1–1½ inches long and about ½ inch thick, consisting of glabrous, imbricated, 3-lobed bracts subtending winged nutlets, both deciduous in the autumn from the slender rachis. Nutlets compressed, oblong to obovate, about ⅛ of an inch long, surmounted at the apex by the 2 persistent styles, with lateral marginal wings as broad as the nutlet.

Winter characters — Twigs slender, lenticellate, smooth, lustrous, light reddish brown, at length dull dark brown tinged with red, with wintergreen taste when chewed. Short spur-like lateral fruiting branches present. Staminate aments grouped at the tips of vigorous branchlets, oblong-cylindric, reddish brown, lustrous, about ¾ of an inch long. Buds ovate, acute, lustrous, divergent, light chestnut-brown, about ¼ of an inch long. Bark on young trunks smooth, lustrous, dark reddish brown, with conspicuous horizontal lenticels. Mature bark dull brownish black, furrowed and broken into large, irregular plates.

Habitat — Usually in upland situations on moist or dry gravelly or rocky soils.

Range — Newfoundland, New York and Pennsylvania, south along the mountains to Florida, west through southern Ontario to Iowa and Tennessee. Zones A, **B**, and C.

Uses — Wood heavy, hard, strong, close-grained, dark reddish brown with thin, pale sapwood, capable of high finish and used in the manufacture of furniture to imitate mahogany, likewise for woodenware, fuel, etc. Oil of wintergreen is distilled from the wood, and birch beer can be made by fermenting the sap.



Yellow Birch, Gray Birch

Betula lutea Michx. f.

1. A twig showing pistillate and staminate aments x ½
2. Bract and bracteoles from staminate ament, distal view x 7½
3. Staminate flowers with subtending bracts and sepals, axile view x 7½
4. Bract and bracteoles showing styles, abaxile view x 7½
5. Pistillate flowers with subtending bracts, axile view x 7½
6. A twig showing mature leaves and fruiting strobiles x ½
7. Scale from fruiting strobile, abaxile view x 2
8. Winged nutlet x 4
9. Winter twig with staminate aments x ¼

BETULACEAE

Betula lutea Michx. f.

Yellow Birch, Gray Birch

Habit — A tree at maturity usually 60–75 feet in height with trunk diameter of 2–3 feet, sometimes 100 feet tall and 3–5 feet through. In the open the crown is broadly ovoid, consisting of long, wide-spreading, somewhat pendulous branches borne aloft on a short bole which is continuous into the crown or breaks up a short distance above the ground into several large, ascending limbs. Under forest conditions the bole is usually clean for some distance below.

Leaves — Alternate, ovate, oblong-ovate or elliptical, 3–4½ inches long, 1½–2 inches wide, acute at the apex, rounded or slightly heart-shaped and inequilateral at the base, sharply doubly serrate, at maturity smooth, dull and dark green above, pale yellowish green and hairy at least on the veins below, borne on slender, pale yellow, hairy, terete petioles ¾–1 inch long.

Flowers — Appearing in late March or April before the leaves, monoecious, borne in aments. Staminate aments preformed the preceding season, clustered, subterminal, cylindrical, at anthesis brownish yellow, 3–3½ inches long. Pistillate aments appearing as the buds unfold, terminal and solitary on short, 2-leaved lateral branches, pale green, oblong-cylindrical, nearly sessile, about ⅔ of an inch long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short, bifurcated filaments and accompanied by a calyx of 1 sepal, the cluster of 3 covered distally by a peltate broadly oval bract and 2 bracteoles. The pistillate flower consists of a small, green, ovoid ovary surmounted by 2 spreading, filiform styles, the cluster of 3 subtended by an oblong, obtuse bract and 2 adnate bracteoles.

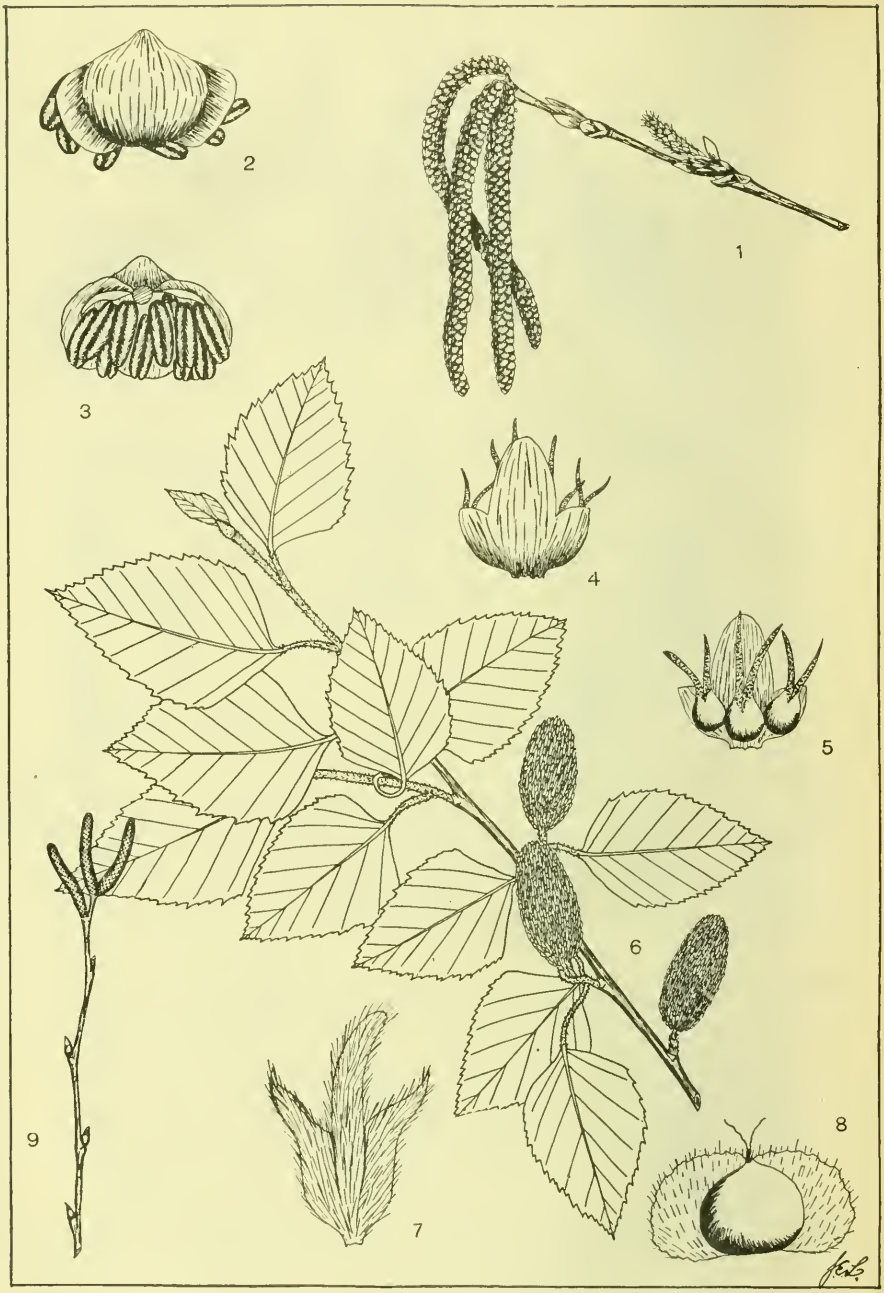
Fruit — An erect, sessile or nearly sessile, pale brown, oblong-ovoid, woody strobile, 1–1½ inches long and about ¾ of an inch wide, consisting of imbricated, 3-lobed bracts which are puberulous on the back and subtend winged nutlets, both deciduous in the autumn from the slender rachis. Nutlets compressed, ovate to oval, chestnut-brown, about ⅛ of an inch long, crowned by the 2 persistent styles, with lateral marginal wings narrower than the nutlet.

Winter characters — Twigs slender, lenticellate, smooth, light yellowish brown, becoming dark brown and lustrous and finally dull silvery-gray, with faint wintergreen odor when chewed. Short, spur-like, lateral fruiting branches present. Buds narrowly ovate, acute, lustrous, somewhat divergent, chestnut-brown, about ¾ of an inch long, covered by 3–8 scales downy on the margins. Staminate aments grouped at the tips of vigorous twigs, oblong-cylindric, light chestnut-brown and lustrous, ¾–1 inch long. Bark on young trunks or limbs lustrous, close and firm, bright silvery-gray, separating at the surface into thin, revolute, clinging scales. Mature bark reddish brown to nearly black, broken into large, thick, irregular plates.

Habitat — Rich moist uplands in company with Beech, Sugar Maple, Ash, Hornbeam, Hemlock, Red Spruce, etc.

Range — Newfoundland south along the mountains to North Carolina and Tennessee, west through southern Ontario, Michigan and Wisconsin to Minnesota. Zones B, **C**, **D**, and E.

Uses — Wood heavy, hard, strong, close-grained, light reddish brown with thin, nearly white sapwood. Used for furniture, flooring, interior finish, agricultural implements, turnery, and for fuel.



River Birch, Red Birch, Black Birch

Betula nigra L.

1. A twig showing pistillate and staminate aments x 1
2. Bract and bracteoles from staminate ament showing stamens, distal view x 8
3. Staminate flowers with subtending bracts and sepals, axile view x 8
4. Bract and bracteoles from pistillate ament showing styles, abaxile view x 6
5. Pistillate flowers with subtending bracts, axile view x 6
6. A twig showing mature leaves and fruiting strobiles x ½
7. Scale from fruiting strobile, abaxile view x 2
8. Winged nutlet x 4
9. Winged twig x ½

BETULACEAE

Betula nigra L.

River Birch, Red Birch, Black Birch

Habit — A tree 30–60 feet in height with a short trunk usually dividing near the base into several large, obliquely ascending limbs which form in age a round-topped, open, irregular crown. Under optimum conditions sometimes 80–100 feet in height with a bole 4–5 feet through, at other times a bushy tree branching from the ground.

Leaves — Alternate, rhombic-ovate, 1½–3 inches long, 1–2 inches wide, acute at the apex, cuneate at the base, doubly serrate, at maturity thin but firm in texture, dark green, smooth, and lustrous above, pale yellowish green and glabrous or slightly pubescent below, borne on slender, pubescent petioles about ½ of an inch long. Stipules pale green, ovate, fugacious.

Flowers — Appearing in March and April before the leaves, monoecious, borne in aments. Staminate aments preformed the preceding season, clustered, subterminal, cylindrical, at anthesis brownish yellow, 2–3 inches long. Pistillate aments appearing as the buds unfold, terminal and solitary on short, 2-leaved lateral branches, bright green, cylindrical, pedunculate, about ⅓ of an inch long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short, bifurcated filaments accompanied by a calyx of 1 sepal and covered distally by a peltate, broadly oval bract and 2 bracteoles. Pistillate flowers consisting of a small, green, ovoid ovary surmounted by 2 spreading filiform styles, the cluster of 3 subtended by an oblong, obtuse bract and 2 bracteoles.

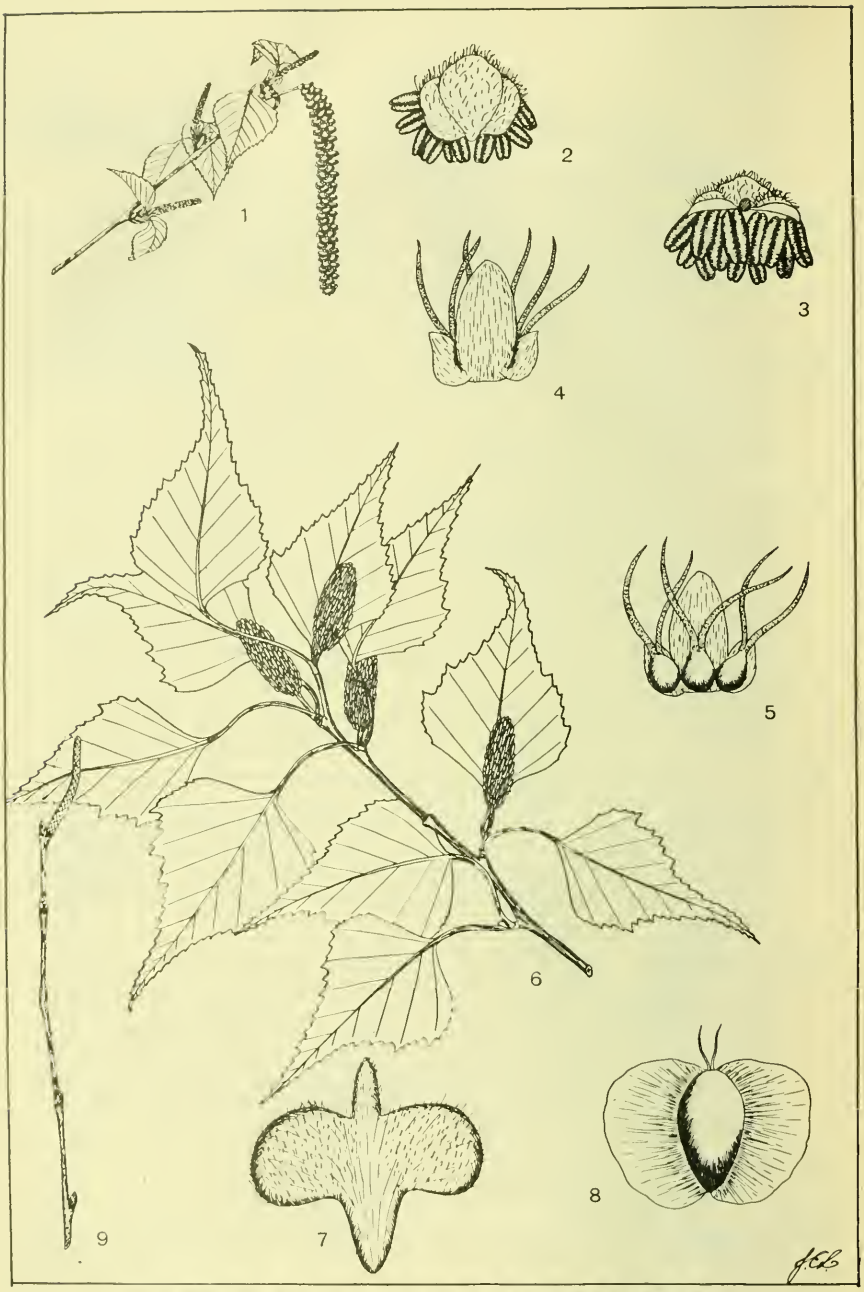
Fruit — An erect, pedunculate, pubescent, pale brown, ovoid-cylindrical, woody strobile, 1–1½ inches long and about ½ inch wide, consisting of imbricated, 3-lobed bracts which are pubescent on the back and subtend winged nutlets, both deciduous in mid-summer from the slender rachis. Nutlets compressed, broadly oval, chestnut-brown, about ⅛ of an inch long, crowned by the 2 persistent styles, with lateral, marginal, pubescent wings narrower than the nutlet.

Winter characters — Twigs slender, lenticellate, smooth, reddish brown and lustrous, at length darker, the bark exfoliating in thin, papery scales. Buds ovate, acute, smooth or somewhat hairy, divergent, covered by 3–7 chestnut-brown scales. Staminate aments clustered, subterminal, cylindrical, ¾–1 inch long. Bark on limbs and upper part of bole light reddish brown to cinnamon red, exfoliating in papery, clinging scales, giving the trunk a ragged appearance. Mature bark at the base of the trunk dark reddish brown and fissured.

Habitat — A moisture-loving species typically found along the banks of streams, ponds, and lakes, more rarely on drier sites.

Range — Central New England, south to Florida, west to Minnesota and Texas. Zones A, B, and C.

Uses — Wood light, medium hard, strong, close-grained, light brown with wide, pale sapwood. Used in the manufacture of cheap furniture and woodenware. The tree is attractive ornamentally and is grown in parks, cemeteries and private estates.



Gray Birch, Old Field Birch, White Birch

Betula populifolia Marsh.

1. A twig showing pistillate and staminate aments x ½
2. Bract and bracteoles from staminate ament showing stamens, distal view x 5
3. Staminate flowers with subtending bracts and sepals, axile view x 5
4. Bract and bracteoles from pistillate ament showing styles, abaxile view x 15
5. Pistillate flowers with subtending bracts, axile view x 15
6. A twig showing mature leaves and fruiting strobiles x ½
7. Scale from fruiting strobile, abaxile view 5
8. Winged nutlet x 10
9. Winter twig x ½

BETULACEAE

Betula populifolia Marsh.

Gray Birch, Old Field Birch, White Birch

Habit — A small tree 20–35 feet high with a trunk diameter of 6–12 inches, occasionally 50 feet tall with a diameter of 18 inches. The boles usually arise in groups of 2–6 from a common root-crown. Crown open, rather irregular, narrowly pyramidal, often extending to the ground, consisting of slender, ascending or horizontal branches and drooping branchlets. Bole continuous to the top of the crown.

Leaves — Alternate, triangular to rhombic-ovate, 2½–3 inches long, 1½–2½ inches wide, long attenuate at the apex, cuneate or truncate at the base, coarsely doubly serrate, at maturity thin but firm in texture, dark green, lustrous and somewhat glandular above, pale green and glabrous or hairy on the veins below, borne on long, black-glandular, terete petioles.

Flowers — Appearing in late March or April with the leaves, monoecious, borne in aments. Staminate aments preformed the previous season, usually solitary, subterminal, narrowly cylindrical, at anthesis brownish yellow, 2½–4 inches long. Pistillate aments appearing as the buds unfold, terminal and solitary on short, 2-leaved lateral branches, pale green, linear-cylindical, pedunculate, ½–1 inch long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short bifurcated filaments and accompanied by a calyx of 1 sepal, the cluster of 3 covered distally by a peltate, obovate bract and 2 bracteoles. Pistillate flowers consisting of a small, green, ovoid ovary crowned by 2 spreading, filiform, pale red styles, the cluster of 3 subtended by an oblong, obtuse bract and 2 adnate bracteoles.

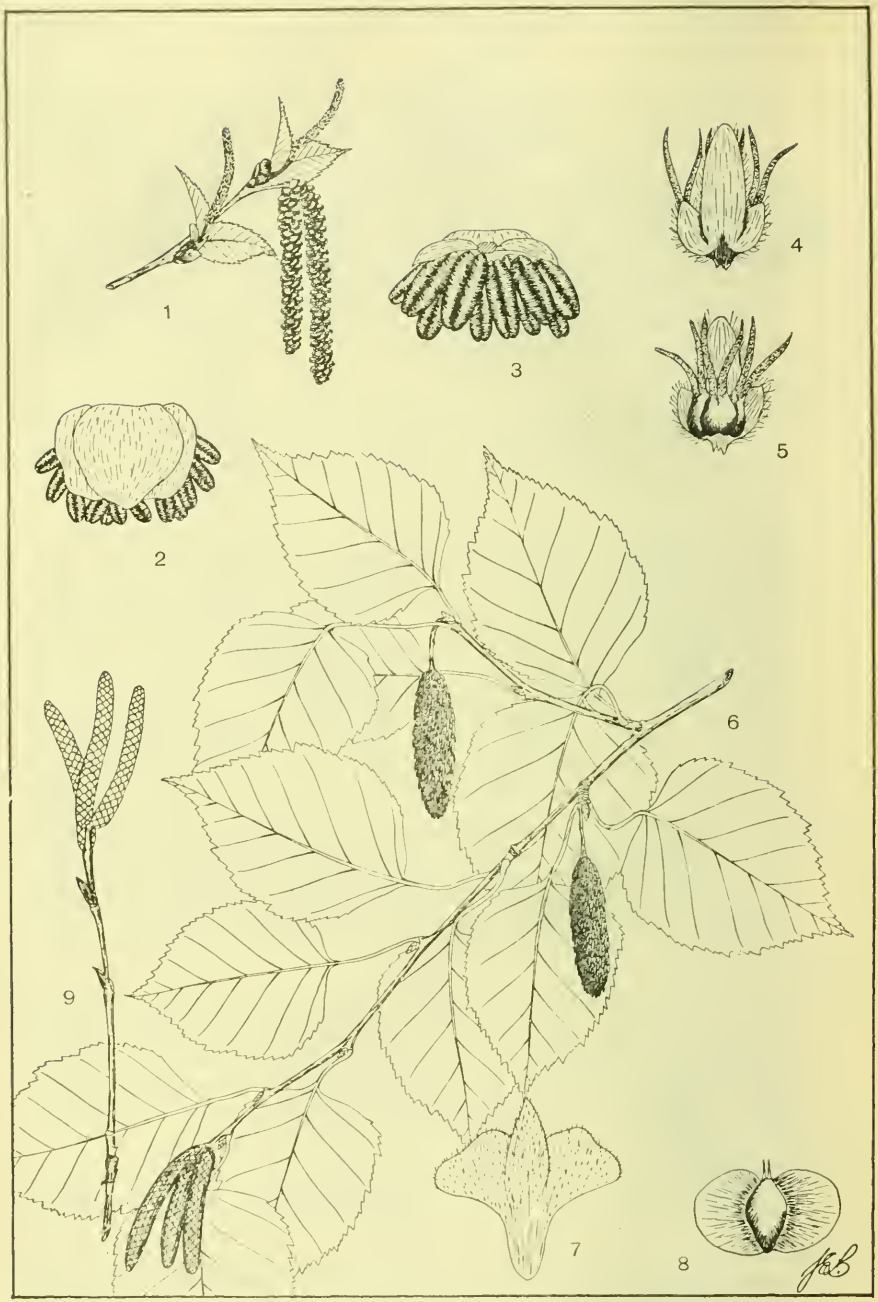
Fruit — A pedunculate, pale brown, cylindrical, obtuse, woody strobile, about ¾ of an inch long and ¼ of an inch wide, consisting of puberulous, imbricated, 3-lobed bracts subtending winged nutlets, both deciduous in the autumn from the slender rachis. Nutlets compressed, oval-obovate, chestnut-brown, 1/16–1/12 of an inch long, crowned by the 2 persistent styles, with lateral marginal wings broader than the nut.

Winter characters — Twigs slender, lenticellate, lustrous, roughened by warty glands, reddish brown or nearly white near the trunk. Buds ovate, acute, smooth, somewhat resinous and divergent, covered by 3–4 scales downy at the margins. Staminate aments usually solitary, subterminal, linear-cylindrical, 1¼–1½ inches long. Mature bark thin, close, dull grayish white with bright orange inner bark, nearly black and fissured at the base of the tree.

Habitat — A short-lived "weed" tree establishing itself rapidly in abandoned fields, burns and on waste lands. Thrives on moist soil along streams and lakes.

Range — Nova Scotia, south to Delaware and southern Pennsylvania, westward to Central Quebec, southern Ontario, and western New York. Zones A, B, **C**, and D.

Uses — Not an important timber species. Grown ornamentally. Wood light, soft, weak, close-grained, pale brown with thick, nearly white sapwood. Used largely for fuel, also for spools, shoe pegs, etc.



Paper Birch, Canoe Birch, White Birch

Betula alba, var. papyrifera (Marsh.) Spach. [Betula papyrifera Marsh.]

1. A twig showing pistillate and staminate aments x ½
2. Bract and bracteoles from staminate ament showing stamens, distal view x 7
3. Staminate flowers with subtending bracts and sepals, axile view x 7
4. Bract and bracteoles from pistillate ament showing styles, abaxile view 15
5. Pistillate flowers with subtending bracts, axile view x 15
6. A twig showing mature leaves and fruiting strobiles x ½
7. Scale from fruiting strobile x 4
8. Winged nutlet x 4
9. Winter twig x ½

BETULACEAE

Betula alba, var. papyrifera (Marsh.) Spach. [Betula papyrifera Marsh.]*

Paper Birch, Canoe Birch, White Birch

Habit — A tree at maturity usually 50–75 feet in height with a trunk diameter of 1–2 feet, under optimum conditions sometimes 120 feet tall. Crown in young trees extending nearly to the ground, narrowly pyramidal, consisting of short, slender, spreading branches. In mature or crowded trees, the bole is clean below and supports a rather narrow, round-topped, open head with pendulous branches.

Leaves — Alternate, ovate, acuminate at the apex, rounded or cuneate at the base, coarsely doubly serrate, 2–3 inches long, 1½–2 inches wide, at maturity thick and firm in texture, dull dark green and usually eglandular above, pale yellowish green, glabrous or somewhat hairy and marked with minute black glands beneath, borne on stout, yellow, black-glandular petioles. Stipules fugacious.

Flowers — Appearing in April and May with the leaves, monoecious, borne in aments. Staminate aments preformed the preceding season, usually in group of 2–3, subterminal, cylindrical, at anthesis brownish yellow, 3½–4 inches long. Pistillate aments appearing as the buds unfold, terminal and solitary on short, 2-leaved lateral branches, pale green, linear-cylindrical, pedunculate, 1–1¼ inches long. Flowers borne in clusters of 3. The staminate flowers consist of 4 yellow half-anthers raised on short bifurcated filaments and accompanied by a calyx of 1 sepal, the cluster of 3 covered distally by a peltate, broadly obovate bract and 2 bracteoles. Pistillate flowers consisting of a small, green, ovoid ovary crowned by 2 spreading, filiform, bright red styles, the clusters of 3 subtended by an oblong, obtuse bract and 2 bracteoles.

Fruit — A pedunculate, drooping, pale brown, cylindrical, obtuse, woody strobile, about 1½ inches long and ⅓ of an inch thick, consisting of puberulous or glabrous, imbricated, 3-lobed bracts subtending winged nutlets, both deciduous in the autumn from the slender rachis. Nutlets compressed, elliptical to oval, chestnut-brown, about 1/16 of an inch long, with marginal wings broader than the nut.

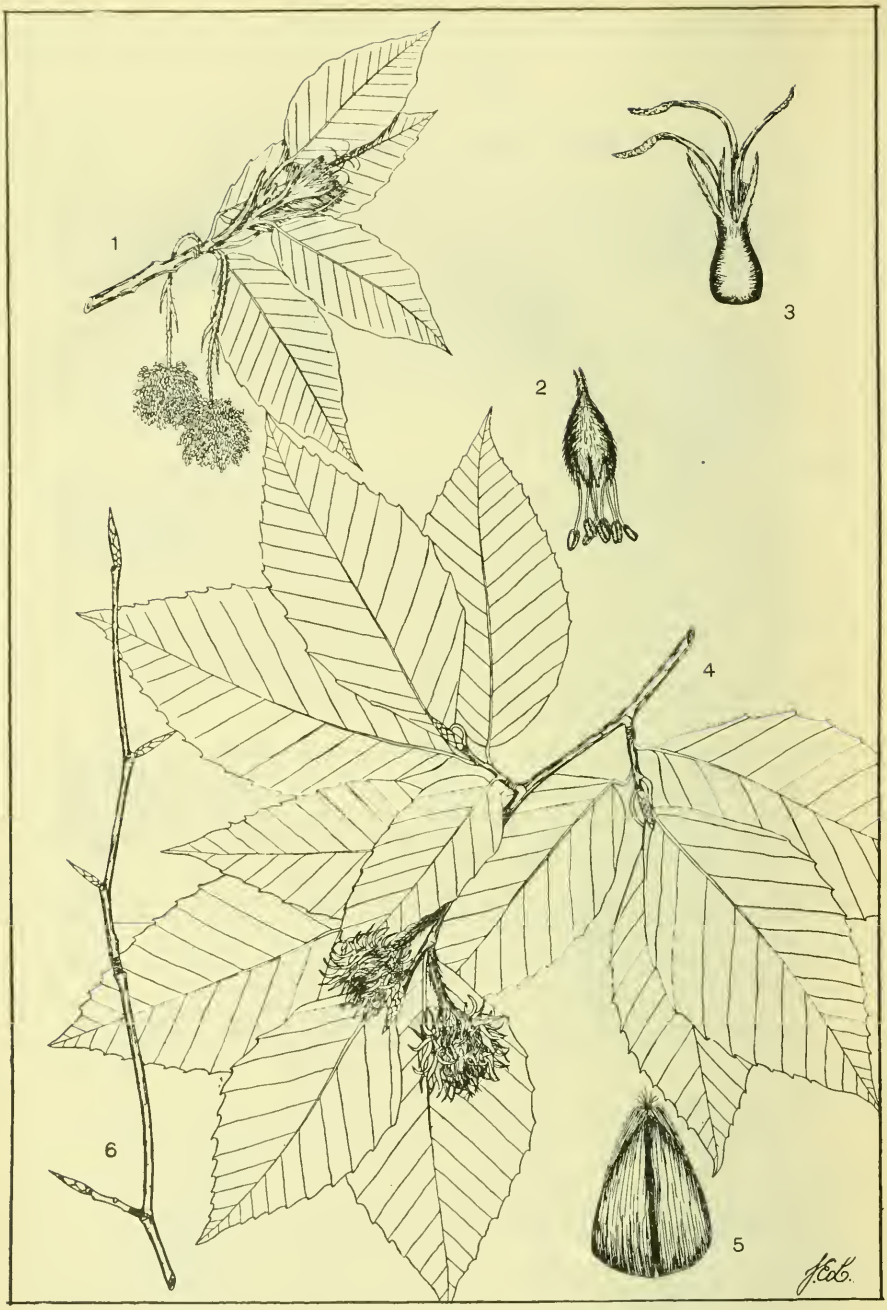
Winter characters — Twigs rather stout, lenticellate, smooth, dull reddish brown, at length orange-brown and lustrous, finally white from the exfoliation of the outer bark. Buds ovate, acute, smooth, divergent, chestnut-brown, covered by 3–5 scales downy at the margins. Staminate strobiles in groups of 2–3, subterminal, cylindrical, ¾–1½ inches long. Bark on the trunk and older branches chalky to creamy-white, peeling off in thin papery layers, marked by elongated, horizontal lenticels. Mature bark at the base of mature trunks brownish black, sharply and irregularly furrowed.

Habitat — Thrives on moist sites about lakes, streams, swamps, wooded mountain slopes and hillsides, usually intermingled with other hardwoods, more rarely with conifers.

Range — A transcontinental species ranging from Newfoundland to Alaska, south through New England to central Pennsylvania, Michigan, Wisconsin, Colorado and Washington. Zones C, D, and **E.**

Uses — Wood light, strong, hard, close-grained, light reddish brown with thick, nearly white sapwood. Largely used in the manufacture of spools, likewise woodenware, shoe-lasts, wood-pulp and fuel. The papery bark is made into canoes and souvenirs. The tree is grown ornamentally in the northern states, replacing in many places the European White Birch destroyed by the Bronze Birch Borer.

*A variety of paper birch, *Betula alba, var. cordifolia* (Regel) Fernald, is found at higher elevations on cool mountain slopes in the Adirondacks and Catskills.



Beech

Fagus grandifolia Ehrh. [Fagus americana Sweet; Fagus atropunicea (Marsh) Sud.; Fagus ferruginea Ait.]

1. A twig showing pistillate and staminate flowers, and immature leaves x 1
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Trigonous nut x 2
6. Winter twig x ½

FAGACEAE

Fagus grandifolia Ehrh. [Fagus americana Sweet; Fagus atropunicea (Marsh) Sud.; Fagus ferruginea Ait.]

Beech

Habit — A tree under optimum conditions sometimes 120 feet in height, usually 60–80 feet in height with a trunk 2–4 feet in diameter. Crown compact and narrow under forest conditions, borne aloft on a long, straight, columnar bole. In the open the trunk is short and thick and breaks up a few feet above the ground into numerous spreading limbs and slender, somewhat drooping branches, forming a broad, round-topped head. Spreads by root suckers.

Leaves — Alternate, oblong-ovate, 2½–5 inches long, 1–3 inches wide, acuminate at the apex, cuneate or rounded at the base, sharply serrate with rather distant teeth, at maturity thin, coriaceous, smooth and dull green above, pale green and lustrous beneath, with tufts of hairs in the axils of the prominent rib-like secondary veins, borne on short, terete, heavy petioles about ¼ of an inch long.

Flowers — Appearing in April or May when the leaves are about one-third grown, monoecious. Staminate flowers in many-flowered, drooping, globose heads which are 1 inch in diameter and are borne on slender, scaly peduncles about 2 inches long arising from the axils of the inner bud-scales or of the lower leaves. Calyx narrowly campanulate, pale hairy without, 4–8-lobed, borne on a short peduncle. Stamens 8–10, with pale green anthers and slender filaments, the filaments about twice the length of the calyx. Pistillate flowers in clusters of 2 on short, clavate, woolly peduncles from the upper leaf-axils, the cluster surrounded by an involucre of accrescent scales clothed with long white hairs and subtended by several deciduous, pink bracts. Calyx hairy, adnate to the ovary, with 4–5 linear lobes. Pistil consisting of a trigonous, 3-celled ovary surmounted by 3 slender, reflexed styles stigmatic on the inner surface.

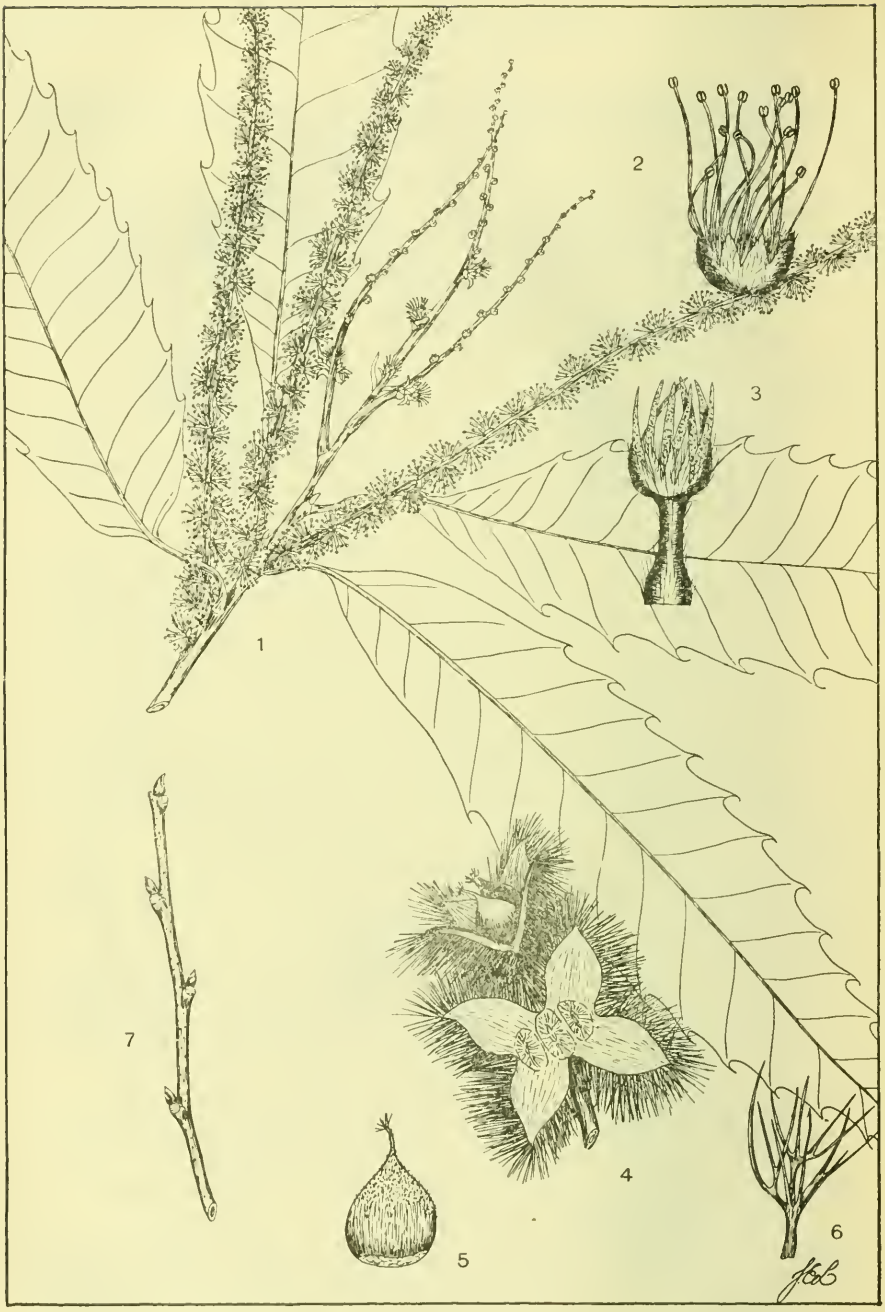
Fruit — A stalked, prickly, thick-walled, ovoid bur, about ¾ of an inch long, opening in the autumn by 4 valves to set free the 2 trigonous, lustrous brown nuts. Kernel sweet, edible.

Winter characters — Twigs slender, zigzag, wiry, orange-lenticellate, smooth, lustrous, bright reddish brown, at length dark brown turning to ashy gray, with tardily deciduous leaves. Buds narrowly conical, sharp-pointed, strongly divergent, ¾–1 inch long, covered by numerous, thin, lustrous, pale chestnut-brown scales with hairy margins. Mature bark thin, close, smooth, dull light gray, often mottled with dark spots.

Habitat — A tolerant species preferring rich, moist uplands in admixture with Hard Maple, Yellow Birch, Hornbeam, Hemlock, etc. In the south occurring on moist bottom-lands and the borders of swamps.

Range — Nova Scotia through southern Ontario to Wisconsin, south to Florida and Texas. Zones B, C, and D.

Uses — A timber species producing a hard, strong, tough, close-grained wood which is susceptible of high polish but difficult to season and not durable in contact with the soil. Heartwood light or dark red; sapwood nearly white. The wood is used for cheap furniture, tool handles, basketry (as veneer), and largely in the rural districts for fuel. The tree is to be recommended ornamentally because of its striking appearance, especially during the winter months. The nuts occasionally appear in the eastern markets.



Chestnut

Castanea dentata (Marsh.) Borkh. [Castanea vesca, var. americana Michx.; Castanea sativa, var. americana Sarg.]

1. A twig showing pistillate and staminate flowers and mature leaves x ½
2. A staminate flower, lateral view x 8
3. A pistillate flower, lateral view x 10
4. Opened burs showing nuts and nut-scars x ½
5. Nut x 1
6. Spine from bur x 1½
7. Winter twig x ½

FAGACEAE

Castanea dentata (Marsh.) Borkh. [Castanea vesca, var. americana Michx.; Castanea sativa, var. americana Sarg.]

Chestnut

Habit — An important timber species, usually 60–80 feet tall, under optimum conditions sometimes 100 feet in height with a restricted crown and tall columnar trunk 3–4 feet in diameter. Trees in the open have a short, massive bole which soon breaks up into stout, wide-spreading limbs to form a very broad, ovate, rounded head. Chestnut sprouts readily from the stump after cutting (coppice growth) and it is not uncommon to find several trees that have arisen from sprouts in this way, grouped about an old stump.

Leaves — Alternate, oblong-lanceolate, 6–8 inches long, 1½–2 inches wide, acuminate at the apex, cuneate at the base, coarsely serrate, at maturity thin, glabrous, dull, dark green above, smooth and pale yellow beneath, borne on stout, puberulent petioles about ½ of an inch long.

Flowers — Appearing in late June or July after the leaves have attained full size, monoecious. Staminate flowers in erect deciduous aments 6–8 inches long consisting of stout, green, puberulous stems arising from the axils of the leaves of the year or of the inner scales of the terminal bud, and sessile flower clusters. Calyx campanulate, pale brown, puberulous, 6-lobed. Stamens 10–20, with long, slender, white filaments and pale yellow anthers. Pistillate flowers at the base of the upper androgynous aments in clusters of 3 (2–5), each cluster enclosed in a green, sessile involucre of thick, imbricated, sharp-pointed, slightly hairy scales subtended by several bracts. Calyx hairy, adnate to the ovary, with short, 6-lobed limb. Pistil consisting of a 6-celled ovary surmounted by 6 white, linear, spreading styles stigmatic at the apex.

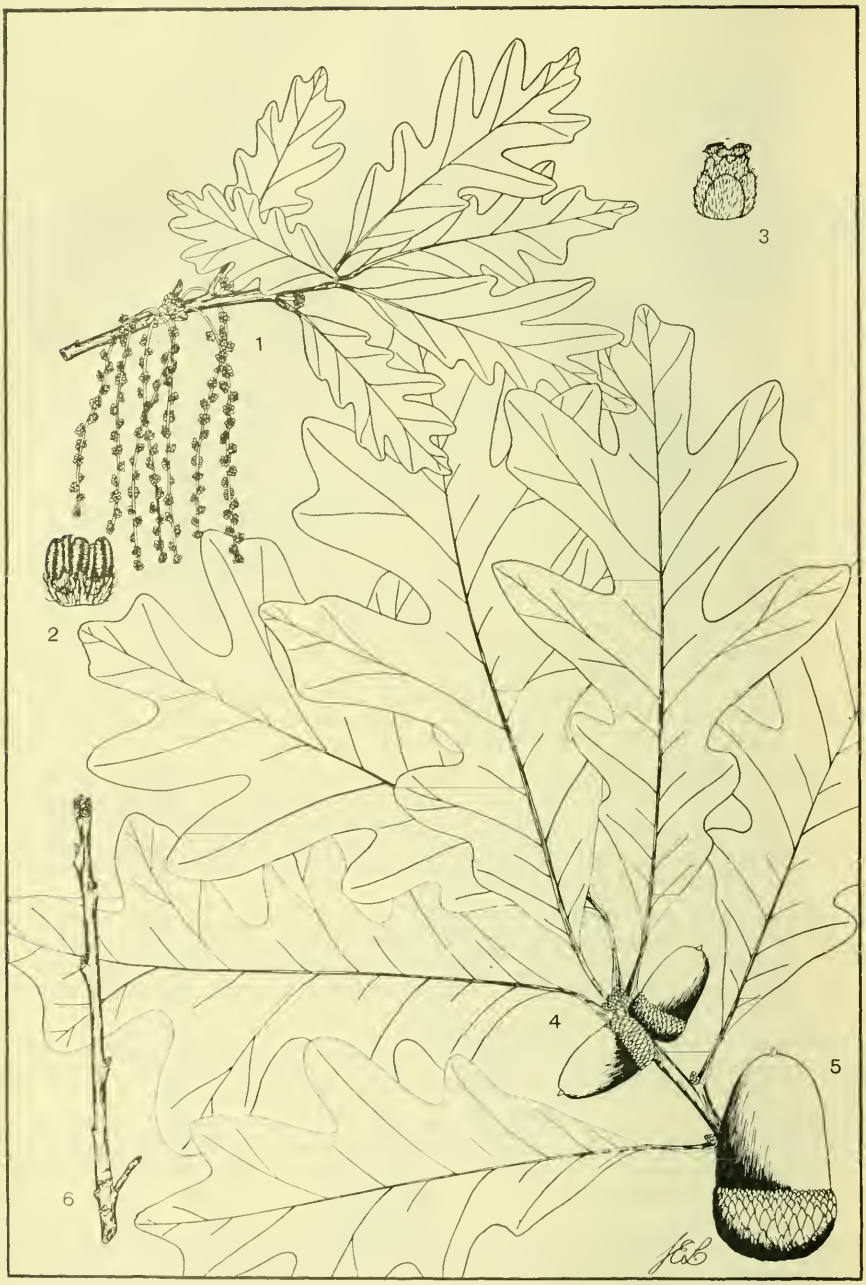
Fruit — A sessile, globose, light brown bur, 2–2½ inches in diameter, densely echinulate with branched spines and usually tomentose without, opening the first autumn by 4 valves and exposing the 1–3 nuts and the velvety inner surface. Nuts ovoid, laterally compressed, pubescent at the apex, lustrous below, dark chestnut-brown, marked at the base by a large, pale, oval scar. Kernel sweet, edible.

Winter characters — Twigs rather stout, white-lenticellate, smooth, lustrous, olive or yellowish green, at length dark brown. Terminal bud absent. Lateral buds ovate, acute, divergent, dark chestnut-brown. Mature bark dark brown, thick, divided by shallow fissures into broad, flat ridges scaly on the surface.

Habitat — Thrives on a wide variety of sites and soils but avoids a wet habitat. In the north common on gravelly, well-drained, glacial soils; farther south it is an inhabitant of cool mountain slopes.

Range — Maine westward through southern Ontario to Michigan, southward to Delaware and along the mountains to Alabama, Mississippi, Kentucky and Tennessee. Attains its best development in the mountains of the South. Zones A, B, and C.

Uses — An important timber tree. Wood light, soft, rather weak, coarse-grained, difficult to season but very durable in contact with the soil. Heartwood reddish brown; sapwood thin and pale. Largely used for railroad ties, telephone and telegraph poles, fence posts, coffins, cheap furniture, interior finish and as a source of tannin extract. The tree is important silviculturally because of the readiness with which it may be coppiced. The chestnuts of commerce are produced by this species. The supply of American Chestnut has been greatly depleted through the ravages of the chestnut-bark disease.



White Oak

Quercus alba L.

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig x ½

FAGACEAE

Quercus alba L.

White Oak

Habit — A valuable timber species, usually attaining a height of 60–80 feet with a trunk 2–4 feet in diameter, under optimum conditions sometimes 140 feet tall. Trees in dense forest stands have long, clean boles with little taper, bearing aloft a narrow crown. In the open the bole is short and stout and soon breaks up into massive, gnarled, wide-spreading limbs and slender rigid branches to form a broad, open, irregular crown.

Leaves — Alternate, obovate-oblong, 5–9 inches long, 2–4 inches wide, cuneate at the base, 3–9-lobed, the lobes ascending and blunt and separated by wide, rounded sinuses which are shallow or may extend nearly to the midrib. Upper lobes irregular, often with secondary lobes at the apex. At maturity leaves thin, firm, glabrous, dull or lustrous and bright green above, paler, smooth and sometimes glaucous beneath. Petioles stout, glabrous, ½–1 inch long.

Flowers — In our range appearing in late May or early June when the leaves are about one-third grown, monoecious. Staminate flowers ebracteolate, in interrupted, filiform, pendulous, deciduous aments 2½–3 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx campanulate, bright yellow, pubescent, acutely lobed. Stamens 4–6, with filiform exserted filaments and yellow, notched anthers. Pistillate flowers solitary, peduculate or nearly sessile, borne in the axils of the leaves of the season, each subtended by broadly ovate, hairy involucral scales. Calyx urn-shaped, shallowly lobed, adnate to the ovary. Pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 short, dilated, spreading, red styles stigmatic on the inner surface.

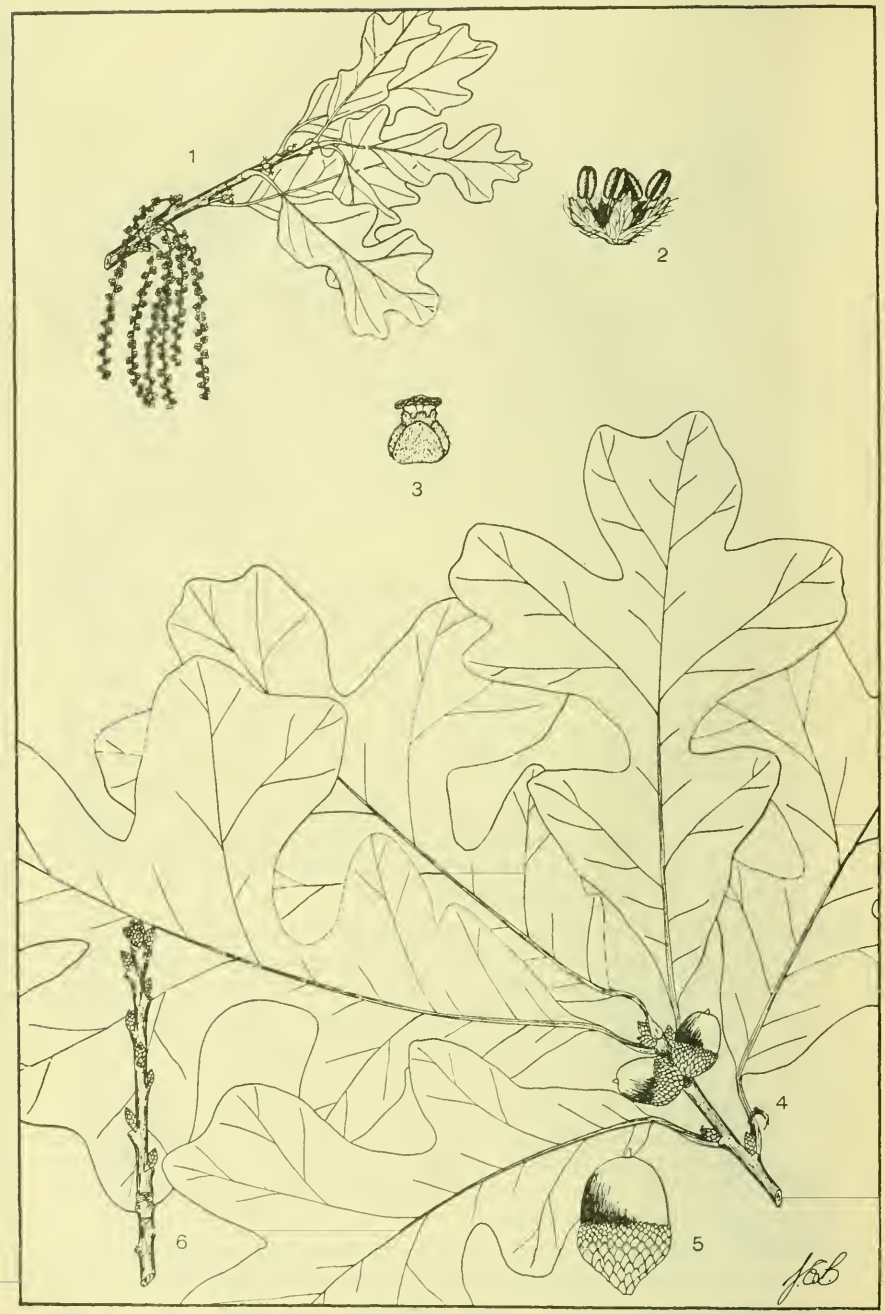
Fruit — A sessile or peduculate acorn, ripening the first season. Nut ovoid-oblong, light chestnut-brown and lustrous at maturity, rounded at the apex, about ¾ of an inch long, enclosed about one-fourth its length in the cup. Cup bowl-shaped, somewhat pubescent within, consisting of numerous scales, those at the base thickened and tuberculate.

Winter characters — Twigs rather slender, pale-lenticellate, lustrous or somewhat glaucous, reddish gray becoming ashy gray the second season. Buds alternate, those near the branch-tip clustered about the terminal bud, broadly ovate, obtuse, reddish brown, about ⅛ of an inch long. Mature bark light gray or nearly white, thick, divided by shallow fissures into long, irregular, thin scales.

Habitat — A cosmopolitan species growing on sandy soil, on moist bottomlands, rich uplands, and stony ridges, preferring rich moist soil.

Range — Maine to Minnesota, south to Florida and Texas. Zones A, B, and C.

Uses — An important lumber species producing the best grade of oak timber. Wood hard, heavy, strong, durable, pale brown with lighter sapwood. Prized for furniture, tight cooperage, wagonry, railroad ties, etc.



Post Oak, Iron Oak

Quercus stellata Wang. [Quercus minor Sarg.; Quercus obtusiloba Michx.]

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig x ½

FAGACEAE

Quercus stellata Wang. [Quercus minor Sarg.; Quercus obtusiloba Michx.]

Post Oak, Iron Oak

Habit — A tree usually 50–60 feet in height with a trunk diameter of 1–2 feet, under optimum conditions sometimes becoming 80–100 feet tall with a long, clean bole, in the northern limits of its range often reduced to a shrub. Crown broad, dense, round-topped, with stout spreading branches, much reduced in forest-grown specimens.

Leaves — Alternate, oblong-obovate, 4–7 inches long, 3–5 inches wide, broadly cuneate at the base, sinuately cut in 5–7 rounded, divergent lobes, the upper 3 much the larger and often notched. At maturity leaves thick, firm, dark green above with scattered stellate hairs, and rusty pubescent beneath. Petioles stout, pubescent, ½–1 inch in length.

Flowers — In our range, appearing in May when the leaves are about one-fourth grown, monoecious. Staminate flowers bracteolate, in interrupted, pendulous, deciduous aments 2½–4 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx campanulate, yellow, hirsute, with laciniate, acute lobes. Stamens 4–6, with filiform, exserted filaments and yellow, notched anthers. Pistillate flowers sessile or pedunculate, borne in the axils of the leaves of the season, each subtended by broadly ovate, hirsute involucral scales. Calyx campanulate, shallowly lobed, adnate to the ovary. Pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 short, dilated, red styles stigmatic on the inner surface.

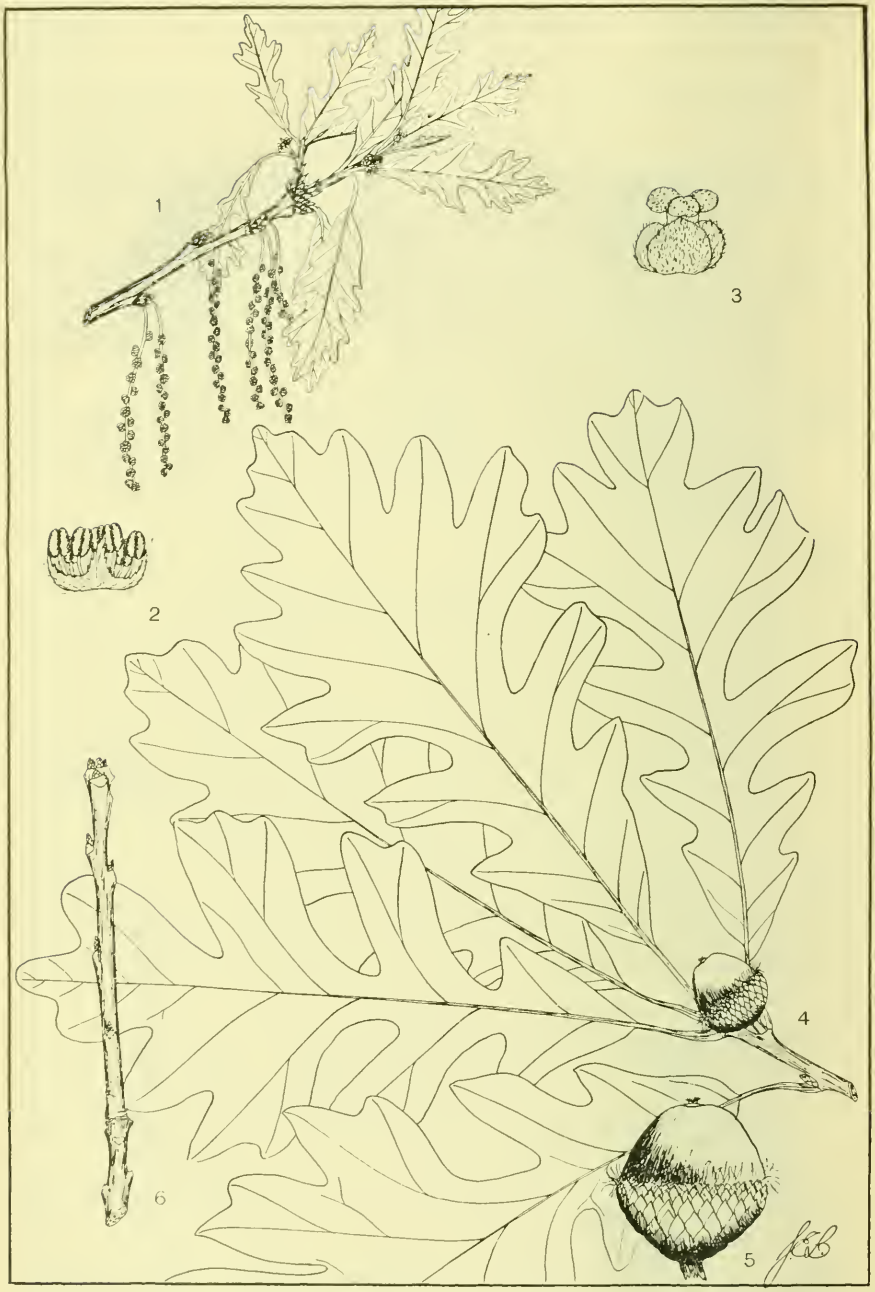
Fruit — A sessile or pedunculate acorn, ripening in one season. Nut oval, obtuse and often pubescent at the apex, light chestnut-brown and striate, ½–1 inch long, enclosed about one-third of its length in the cup. Cup turbinate, downy within, consisting of numerous thin, flat, tomentose scales.

Winter characters — Twigs stout, pubescent, pale-lenticellate, orange to reddish brown, at length dark brown or nearly black. Buds alternate, those near the branch-tip clustered about the terminal bud, broadly ovate, bluntly acute, chestnut-brown and pubescent, ⅛–¼ of an inch long. Mature bark grayish brown, thick, divided by deep fissures into broad ridges, scaly on the surface.

Habitat — An upland species preferring dry, sandy or gravelly sites. Thrives on limestone soils.

Range — Central New England west to Kansas and Missouri, south to Florida and eastern Texas. Usually shrubby in the northeast. Zones A and B.

Uses — Wood hard, heavy, close-grained, durable, pale brown with lighter sapwood. It is not distinguished in the trade from that of *Quercus alba* and is put to similar uses.



Bur Oak, Mossy-cup Oak, Over-cup Oak

Quercus macrocarpa Michx.

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig x ½

FAGACEAE

Quercus macrocarpa Michx.

Bur Oak, Mossy-cup Oak, Over-cup Oak

Habit — One of the largest of American oaks, under optimum conditions sometimes 170 feet in height with a trunk 4–7 feet in diameter which is free of branches for 50 feet or more. Usually smaller, becoming shrubby at the northern limits of its range. Crown in the open broad and round-topped, with massive, spreading limbs and drooping, bushy branchlets.

Leaves — Alternate, obovate or oblong, 6–12 inches long, 3–6 inches wide, cuneate at the base, sinuately cut or nearly divided into 5–7 lobes, the terminal lobe the larger and crenately lobed. At maturity leaves thick, firm, lustrous and usually smooth above, greenish or silvery pubescent below. Petioles stout, ⅓–1 inch long.

Flowers — In our range appearing in late May or early June when the leaves are about one-fourth grown, monoecious. Staminate flowers in interrupted, hairy, filiform, pendulous, deciduous aments, 4–6 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx hemi-spherical, yellowish green, pubescent with 4–6 laciniate lobes. Stamens 4–6, with short filaments and yellow, glabrous anthers. Pistillate flowers sessile or pedunculate, solitary or paired, borne in the axils of the leaves of the season, each subtended by broadly ovate, pubescent involucral scales. Calyx campanulate, shallowly lobed, adnate to the ovary. Pistil enclosed aside from the 3 spreading styles which are reddish and stigmatic on their inner surface.

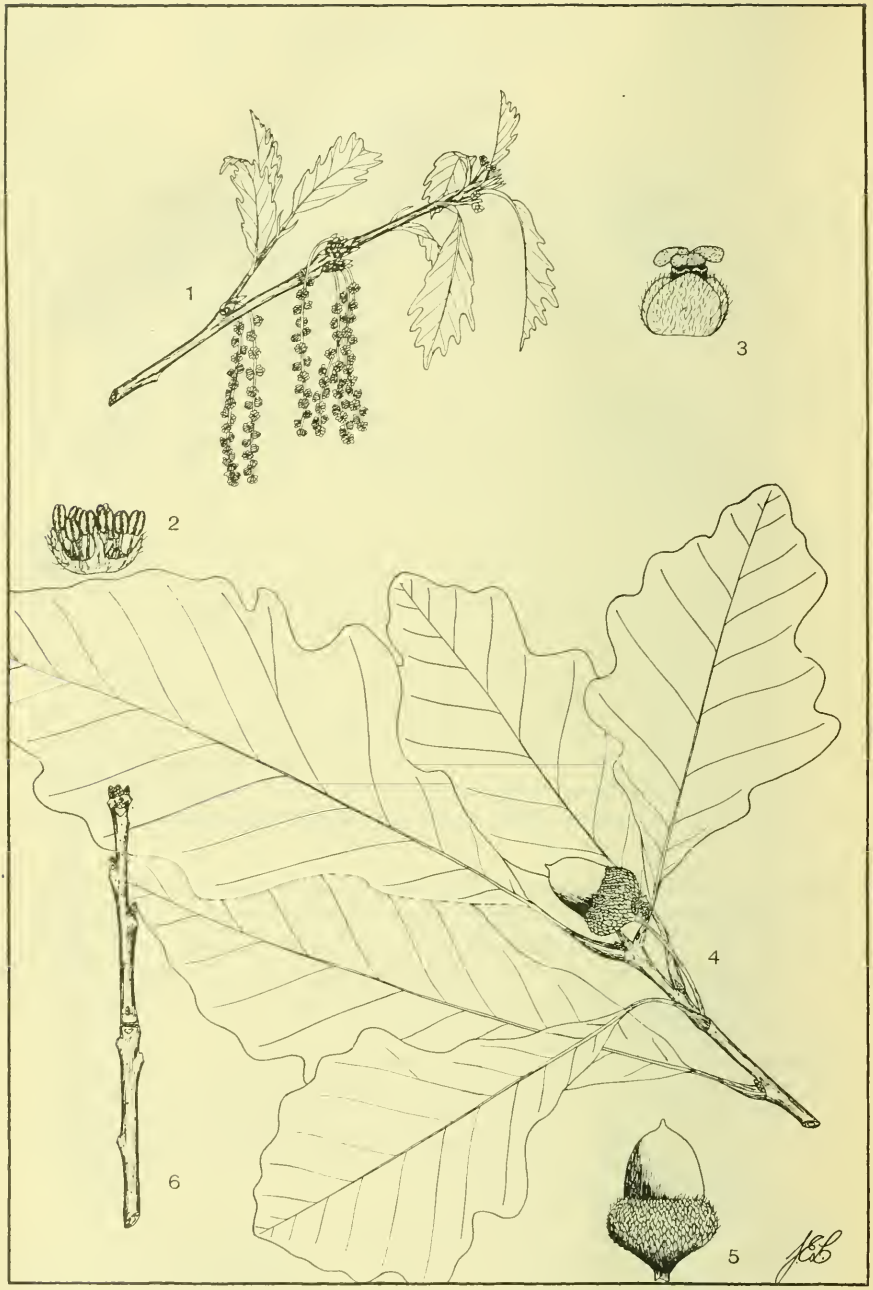
Fruit — A sessile or short-pedunculate acorn ripening the first season. Nut chestnut-brown, oval or broadly ovate, rounded and finely pubescent at the apex, from ⅘–2 inches long, enclosed from one-half to its whole length in the cup. Cup bowl-shaped, pale brown and pubescent within, hoary-tomentose without, with pointed, imbricated scales, the upper prolonged to form a fringe.

Winter characters — Twigs stout, pale-lenticellate, glabrous, pale orange-yellow, at length dark brown. Older twigs often develop corky wings. Buds alternate, those near the branch-tip clustered about the terminal bud, broadly ovate, obtuse, pubescent, pale reddish brown, ⅛–¼ of an inch long. Mature bark pale brown, medium thick, divided by deep furrows into irregular, scaly plates.

Habitat — A bottom-land species preferring rich, deep, moist soils, more rarely on drier, upland sites.

Range — Nova Scotia to Manitoba and Montana, south to Pennsylvania, Tennessee and Texas. Zones A, **B**, and C.

Uses — A valuable timber species producing lumber equivalent in quality to that of White Oak. Wood hard, heavy, strong, durable, rich brown with paler sapwood. Prized for furniture, cooperage, interior finish, railroad ties, etc.



Swamp White Oak

Quercus bicolor Willd. [Quercus platanoides Sudw.]

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit, x ½
5. Nut with cup, lateral view x ¾
6. Winter twig x ½

FAGACEAE

Quercus bicolor Willd. [Quercus platanoides Sudw.]

Swamp White Oak

Habit — A tree usually 60–80 feet high when mature with a trunk 2–4 feet in diameter, occasionally under optimum conditions 100 feet tall. In the open the crown is broad, open, and round-topped with basal drooping branches which give the tree a bizarre appearance. In dense stands the bole is free of branches for some distance, continuing well into the crown.

Leaves — Alternate, obovate or oblong-obovate, 5–6 inches long, 2–4 inches wide, rounded at the apex, cuneate at the base, coarsely sinuate-crenate or occasionally pinnatifid, at maturity thick, firm, dark green and lustrous above, white-hoary below, borne on stout petioles ½–¾ of an inch long.

Flowers — Appearing in late May or early June when the leaves are about one-fourth developed, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 3–4 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx campanulate, pale yellowish green, pubescent, deeply cut into 5–9 lanceolate segments. Stamens 5–9, with slender filaments and glabrous, yellow anthers. Pistillate flowers in few-flowered, white-tomentose, pedunculate spikes borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy involucral scales. Calyx campanulate, adnate to the ovary, shallowly lobed above. Pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 short styles stigmatic on their inner surface.

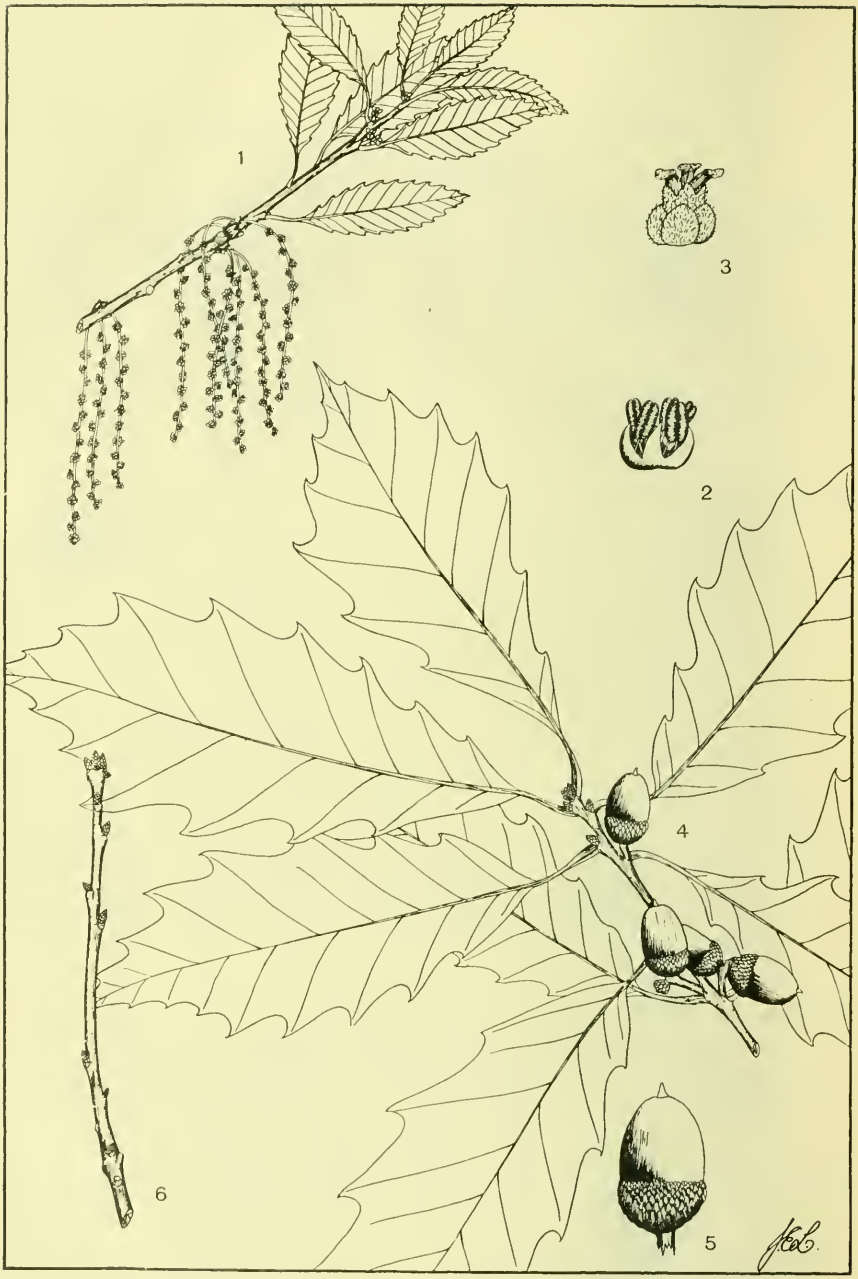
Fruit — An acorn, borne solitary or in pairs on a long peduncle, ripening the first season. Nut oval or oblong, light chestnut-brown, round-pointed and pubescent at the apex, ¾–1¼ inches long, enclosed about one-third of its length in the cup. Cup broadly turbinate, thick, woody, pale brown and pubescent within, hoary-tomentose without, often fringed at the upper margin.

Winter characters — Twigs stout, pale-lenticellate, smooth or puberulous, yellow or reddish brown, at length darker and glaucous. Bark on older branches exfoliating in thin strips. Buds alternate, those near the branch-tip clustered about the terminal bud, broadly ovate, obtuse, pale chestnut-brown, ⅛–¼ of an inch long. Mature bark grayish brown, thick, divided by deep fissures into long, flat ridges scaly at the surface.

Habitat — A bottom-land species preferring moist, fertile soils along stream borders, the edges of swamps, and low, poorly drained pastures.

Range — Maine west to Michigan and eastern Iowa, south to Georgia and Arkansas. Zones A, **B**, and C.

Uses — Wood heavy, hard, strong, close-grained, pale brown with lighter sapwood. It compares favorably with that of White Oak and is used for similar purposes, but is more inclined to knots.



Chestnut Oak, Yellow Oak, Chinquapin Oak

Quercus Muhlenbergii Engelm. [Quercus acuminata Houba.]

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig x ½

FAGACEAE

Quercus Muhlenbergii Engelm. [Quercus acuminata Houba.]

Chestnut Oak, Yellow Oak, Chinquapin Oak

Habit — In our range a shrub or small tree 20–50 feet in height with a trunk ½–2 feet in diameter, in southern Indiana and Illinois attaining an optimum development of 100–160 feet. Crown narrow, round-topped. Bole often buttressed below.

Leaves — Alternate, oblong, lanceolate, or obovate, 4–7 inches long, 1–5 inches wide, pointed at the apex, cuneate or rounded at the base, coarsely and regularly serrate except at the base, at maturity thick, firm, glabrous, yellowish green above, pale silvery-pubescent below, borne on slender, nearly terete petioles ¾–1½ inches long.

Flowers — In our range appearing in late May or early June when the leave are about one-fourth grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 3–4 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx campanulate, yellow, pubescent, deeply divided into 5–6 acute lobes. Stamens as many as the calyx-lobes, with short smooth filaments and yellow, oblong, notched anthers. Pistillate flowers clustered, sessile or pedunculate, white-tomentose, borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy involucral scales. Calyx campanulate, adnate to the ovary, shallowly lobed above. Pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 bright red styles, stigmatic on their inner surface.

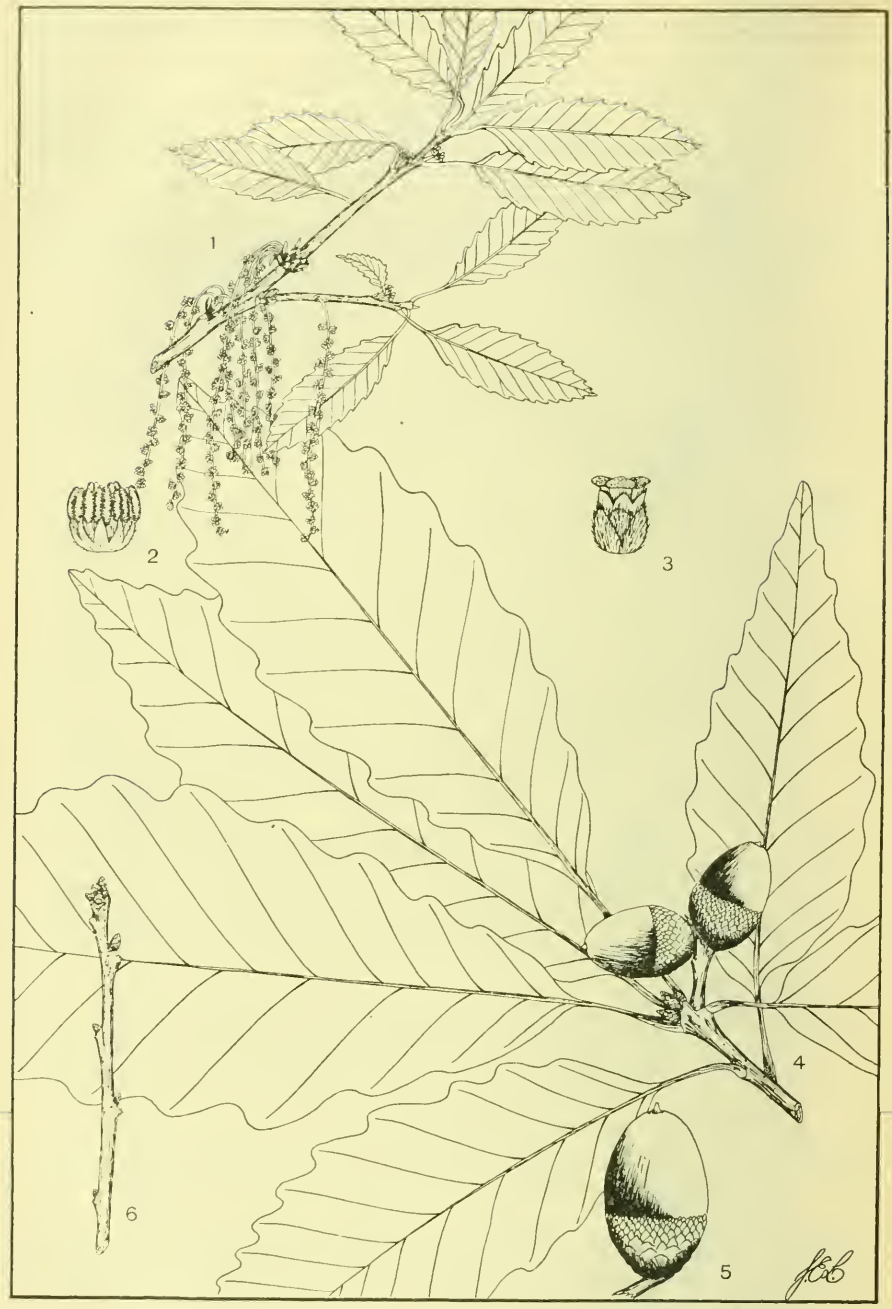
Fruit — An acorn, borne solitary or in pairs on a short peduncle or sessile, ripening the first season. Nut ovoid or oval, pale chestnut-brown, pubescent and round-pointed at the apex, ½–1 inch long, enclosed from one-third to one-half of its length in the cup. Cup bowl-shaped, thin, pale brown and pubescent within, hoary tomentose without, with small obtuse scales.

Winter characters — Twigs slender, pale-lenticellate, smooth, grayish or reddish brown, at length brownish gray. Buds alternate, those near the branch-tip chestnut-brown, ⅛–¼ of an inch long. Mature bark gray or nearly white, thin, shallowly fissured into flat-topped, scaly ridges, approaching in appearance that of *Quercus alba*.

Habitat — In New York State, an upland species preferring barren limestone ridges, farther west attaining its largest size on the bottom-lands of the Wabash river.

Range — Vermont to Iowa and eastern Nebraska, south to the District of Columbia, and southwest through the mountains to Alabama and Texas. Zones A, **B**, and C.

Uses — Wood hard, heavy, strong, close-grained, durable in contact with the soil, dark brown with pale sapwood. Used for wagonry, cooperage, railroad ties, etc. Of minor importance in this state because of its small stature.



Chestnut Oak

Quercus Prinus L. [Quercus Michauxii Nutt.]

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x ¾
6. Winter twig x ½

FAGACEAE

Quercus Prinus L. [Quercus Michauxii Nutt.]

Chestnut Oak

Habit — Usually a medium sized tree 30–70 feet in height with a trunk diameter of 1–4 feet, rarely under favorable conditions 100 feet tall. In the open the bole breaks up 15–20 feet above the ground into stout, spreading limbs which form a broad, low, open, rounded crown. Trees under forest conditions have a stout, columnar bole which continues well into the high, reduced crown.

Leaves — Alternate, obovate, oblong, or lanceolate, 5–9 inches long, 2–4 inches wide, rounded to acuminate at the apex, cuneate at the base, undulately crenate-toothed, at maturity thick, firm, yellowish green and somewhat lustrous above, pale and somewhat pubescent beneath, borne on stout or slender petioles ½–1 inch long.

Flowers — Appearing in late May or early June when the leaves are about one-fourth grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 2–3 inches long which are borne on the growth of the preceding season or from the axils of the inner scale of the terminal bud. Calyx campanulate, light yellow, pubescent, deeply cut into 7–9 acute lobes. Stamens 7–9, with slender glabrous filaments and oblong, glabrous, notched, bright yellow anthers. Pistillate flowers in groups of 2–3 (occasionally solitary), pedunculate, borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy involucral scales. Calyx campanulate, adnate to the ovary, with shallow, ciliate lobes. Pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 short, dilated, spreading, reddish styles stigmatic on the inner surface.

Fruit — An acorn, borne solitary or in pairs on a short peduncle, ripening the first season. Nut oval or ovate, light chestnut-brown and lustrous at maturity, round-pointed at the apex, ¾–1½ inches long, enclosed for about one-third of its length in the cup. Cup bowl-shaped, thin, pale brown and pubescent within, hoary-pubescent without, the scales toward the base tuberculate.

Winter characters — Twigs stout, bitter, pale-lenticellate, smooth, orange to reddish brown, becoming brown or dark brown the second year. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate-conical, acute, light chestnut-brown and pilose, ¼–½ of an inch long. Mature bark dark reddish brown to nearly black, thick, very rough, characteristically divided by deep fissures into broad, rounded, continuous, longitudinal ridges, scaly at the surface.

Habitat — An upland species preferring well-drained sites on ridges, wooded hilltops, the sides of high rocky glens, climbing higher near the southern limits of its range.

Range — Southern Maine to Ontario, south along the mountains to northern Georgia and Alabama. Zones A, B, and C.

Uses — Wood heavy, hard, strong, close-grained, durable in contact with the soil, dark brown with paler sapwood, somewhat inferior to that of White Oak in value. Used for construction, railroad ties, fencing, etc. The bark is an important source of tannin.

Red Oak

Quercus rubra L.

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig x ½

FAGACEAE

Quercus rubra L.

Red Oak

Habit — One of the largest of the oaks, usually 50–80 feet in height with a trunk diameter of 2–4 feet, occasionally under exceptional conditions 150 feet tall. In the open the trunk is short and massive, soon breaking up into stout limbs to form a broad symmetrical crown. In dense stands the bole continues into the narrow, round-topped head.

Leaves — Alternate, oblong to oval-obovate, 5–9 inches long, 4–6 inches wide, acute at the apex, cuneate or rounded at the base, 7–11 lobed, the lobes usually sinuately 3-toothed and bristle-tipped and separated by wide, rounded, oblique sinuses which extend about half way to the midrib. At maturity the leaves are thin, firm, glabrous, dull dark green above, paler and glabrous or puberulous below. Petioles stout, 1–2 inches long.

Flowers — In New York State appearing in late May or early June when the leaves are about half grown, monoecious. Staminate flowers pedunculate in interrupted, filiform, pendulous, hairy aments 4–5 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx campanulate, green, pubescent, deeply cut into 4–5 narrow, ovate lobes. Stamens 4–5, with large, oblong emarginate, yellow anthers. Pistillate flowers in groups of 2–3 (occasionally solitary), pedunculate, borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy, involucral scales. Calyx adnate to the ovary, with lanceolate acute lobes. Pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 elongated, spreading, strap-shaped green styles stigmatic on the inner surface.

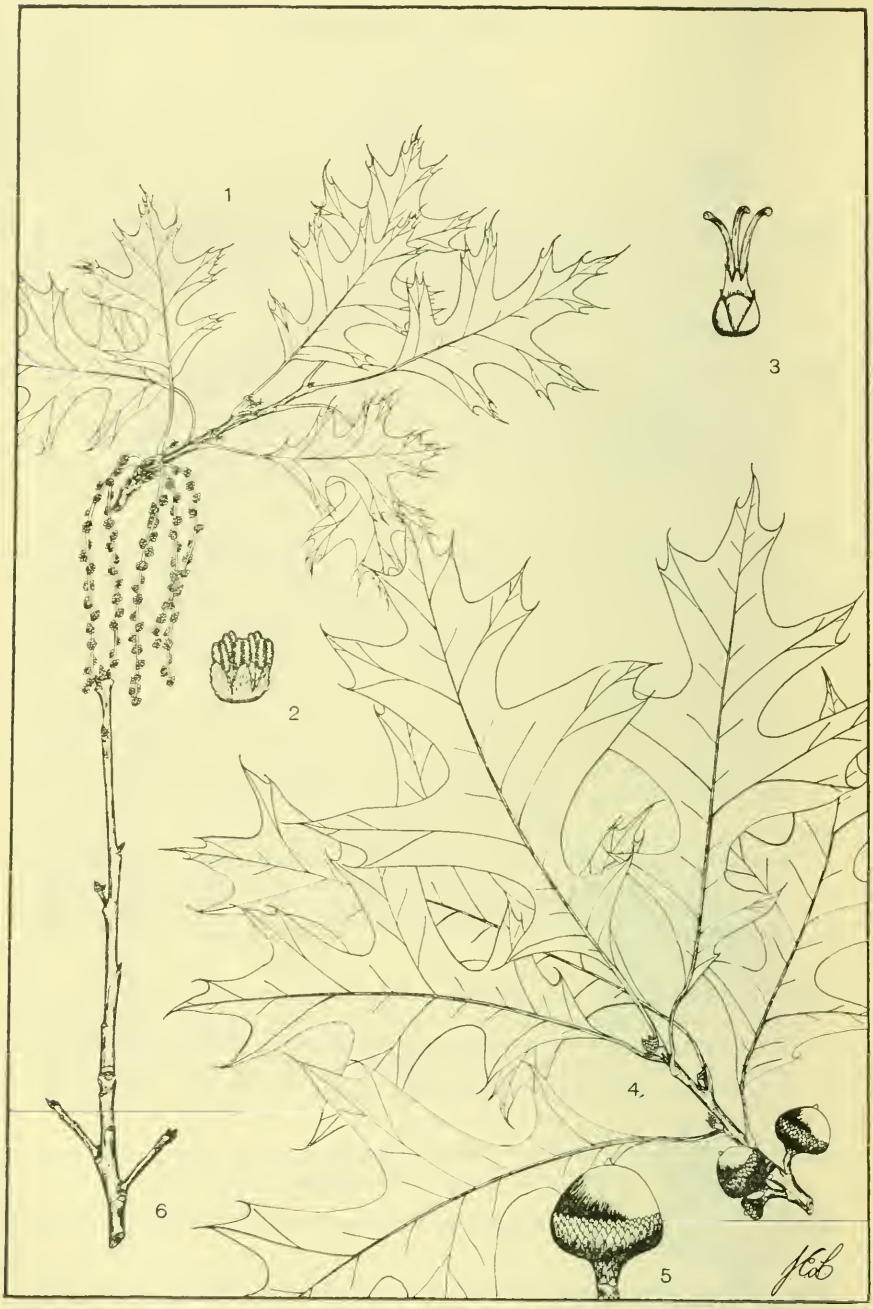
Fruit — An acorn, borne solitary or in pairs, sessile or on a short, stout peduncle, ripening the second season. Nut oblong-ovoid, chestnut-brown and lustrous at maturity, round-pointed at the apex, ¾–1¼ inches long, enclosed for about one-fourth of the length in the cup. Cup saucer-shaped, thick, reddish brown and pubescent within, reddish brown, lustrous and puberulous without.

Winter characters — Twigs slender, pale-lenticellate, smooth, dark red, at length reddish or greenish brown. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, acute, light chestnut-brown, about ¼ of an inch long. Mature bark dark brown, thick, divided by shallow fissures into regular, continuous, flat-topped ridges scaly at the surface.

Habitat — Requires a well-drained site, thriving best on gravelly or sandy loams but not exacting as to soil requirements.

Range — Nova Scotia to Minnesota and Kansas, south to Florida and Texas. Zones A, **B**, and C.

Uses — Wood hard, heavy, strong, close-grained, pale reddish brown with paler sapwood. Used for construction, furniture, interior finish, railroad ties and timbers, but less durable and inferior to that of the white oaks. The most rapidly growing species of oak, recommended over others in silvicultural practice.



Pin Oak, Swamp Spanish Oak

Quercus palustris Muench.

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig x ½

FAGACEAE

Quercus palustris Muench.

Pin Oak, Swamp Spanish Oak

Habit — At maturity a tree usually 60–80 feet in height with a trunk diameter of 2–3 feet, under optimum conditions occasionally 120 feet tall. Crown in young trees symmetrical, conic, at length broader and open, the lower branches pendulous and shorter than those above. Bole straight, clean, continuous into the crown.

Leaves — Alternate, broadly oval to obovate, 4–6 inches long, 2–4 inches wide, acute at the apex, cuneate or truncate at the base, 5–9-lobed, the lobes dentate and bristle-tipped and separated by wide, rounded sinuses which extend more than half way to the midrib. At maturity the leaves are thin, firm, dark green and lustrous above, and paler below. Petioles slender, ½–2 inches long.

Flowers — Appearing in May in our range when the leaves are about one-third grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 2–3 inches long, which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx broadly campanulate, yellowish green, puberulous, deeply cut into 4–5 oblong, rounded, slightly sinuate lobes. Stamens 4–5, the yellow anthers slightly emarginate and glabrous. Pistillate flowers in groups of 2–3 (occasionally solitary), borne on short tomentose peduncles from the axils of the leaves of the season, each subtended by the broadly ovate, tomentose involucral scale. Calyx adnate to the ovary, the lobes acuminate. Pistil consisting of a 3-celled (rarely 4–5 celled) ovary surmounted by 3 elongated, spreading, strap-shaped red styles stigmatic on the inner surface.

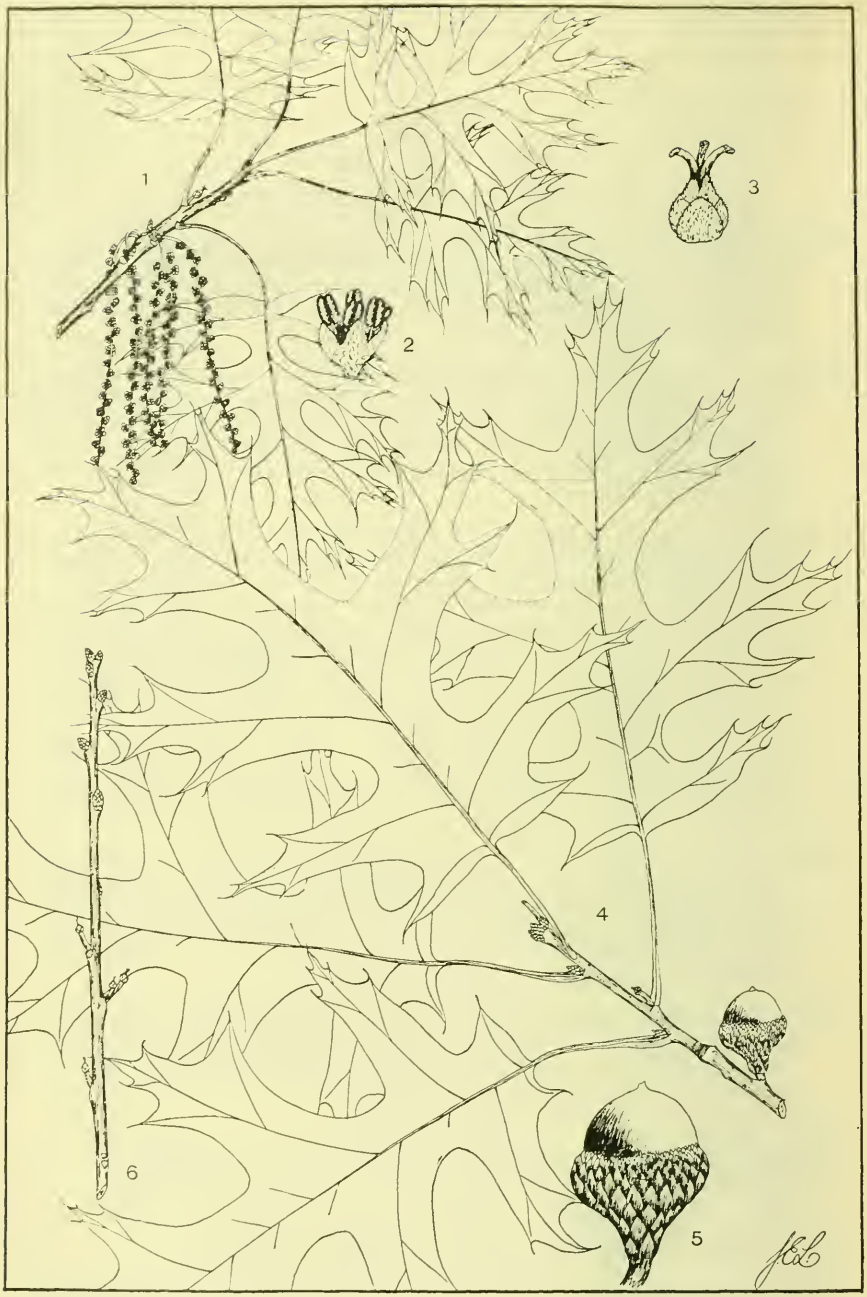
Fruit — An acorn, borne solitary or in pairs, sessile or short stalked, ripening the second season. Nut nearly hemi-spherical, light brown and often striate, round-pointed at the apex, about ½ of an inch long, enclosed for about two-fifths of its length in the cup. Cup thin, shallow, saucer-shaped, dark reddish brown and puberulous within, pale reddish brown without, the scales thin and closely appressed.

Winter characters — Twigs slender, tough, pale-lenticellate, lustrous, dark reddish or grayish brown. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, acute, light chestnut-brown, about ⅛ of an inch long. Mature bark light grayish brown, quite smooth, with low scaly ridges and shallow fissures.

Habitat — A bottom-land species, preferring deep, rich, moist, soil, more rarely on moist upland sites. Transplants thrive well in dry situations.

Range — Central New England west through southern Michigan and Missouri, southward to Virginia, Tennessee and Oklahoma. Zones A and B.

Uses — Not an important timber species. Wood hard, heavy, strong, close-grained, pale brown with lighter sapwood. Used for railroad ties, cheap construction and fuel. The tree is planted extensively for shade and ornament because of its symmetrical form, beautiful foliage, rapidity of growth, and the ease with which it may be transplanted.



Scarlet Oak

Quercus coccinea Muench.

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig with immature acorns x ½

FAGACEAE

Quercus coccinea Muench.

Scarlet Oak

Habit — A medium sized tree 60–80 feet in height with a trunk diameter of 2–3 feet, often much smaller. Crown in the open narrow, irregular, rounded or oblong, with wide-spreading basal branches, in dense stands greatly reduced.

Leaves — Alternate, broadly obovate to oval, 3–6 inches long, 2½–4 inches wide, acute at the apex, truncate or cuneate at the base, 7–9-lobed, the lobes repandly dentate and bristle-tipped at the apex and separated by deep, wide, rounded sinuses which extend over half way to the midrib. At maturity the leaves are thin, firm, glabrous, lustrous and dark green above, and paler below. Petioles slender, 1½–2½ inches long.

Flowers — Appearing in May or early June when the leaves are about half grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 3–4 inches long, borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx campanulate, greenish red, pubescent, cut into 4–5 ovate, acute lobes. Stamens 4–5, with glabrous, pale yellow anthers. Pistillate flowers in groups of 2–3 (or solitary), pedunculate, borne in the axils of the leaves of the season, each subtended by the broadly ovate, hairy, involucral scales. Calyx campanulate, shallowly lobed. Pistil consisting of a 3-celled (rarely 4–5-celled) ovary surmounted by 3 elongated, spreading, strap-shaped, red styles stigmatic on the inner surface.

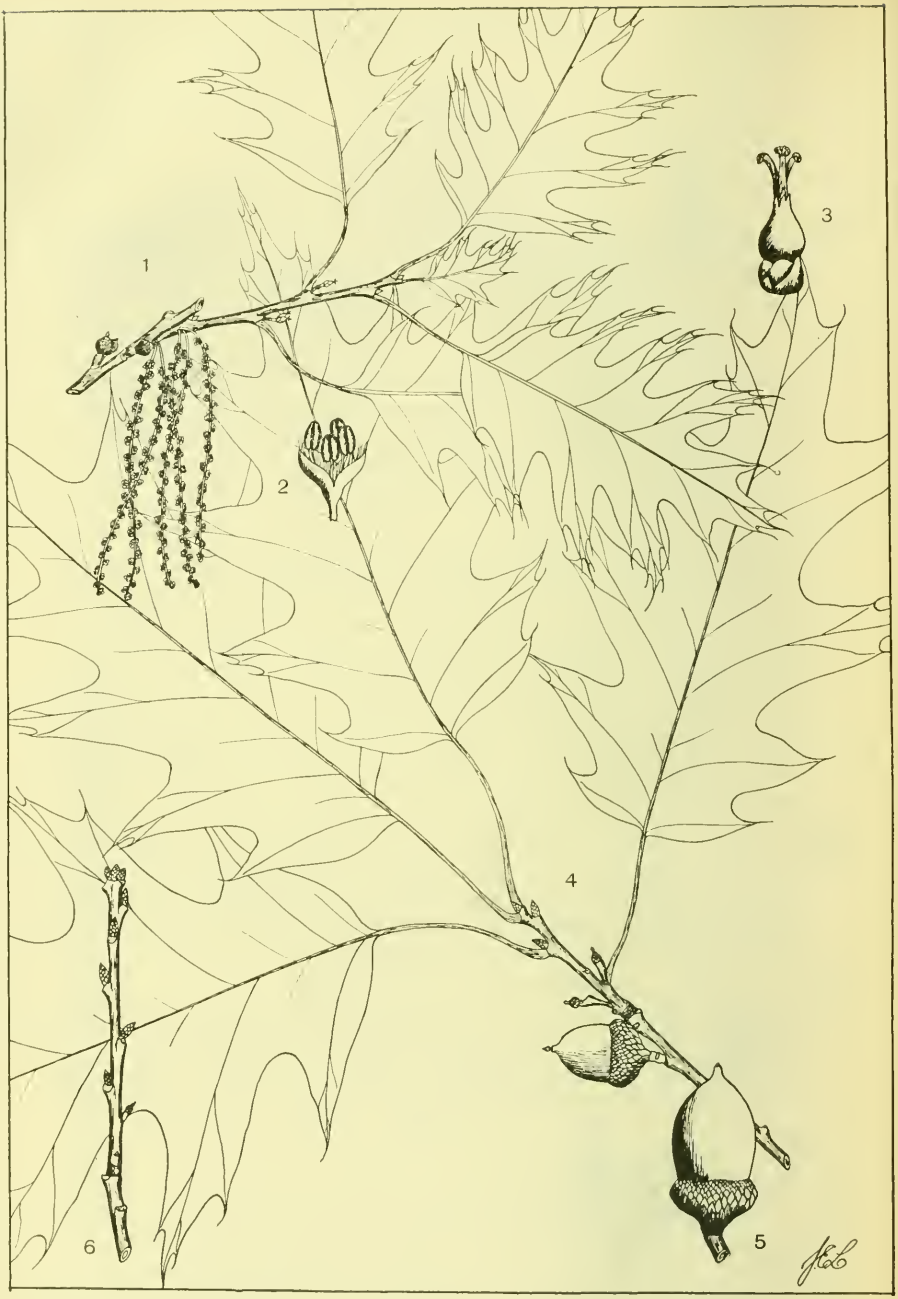
Fruit — An acorn, borne solitary or in pairs, sessile or long pedunculate, ripening the second season. Nut ovoid, pale reddish brown and often striate, round-pointed at the apex, ½–1 inch long, enclosed for one-third to one-half of its length in the cup. Cup turbinate, thin, pale reddish brown within, reddish brown with closely appresssed scales without.

Winter characters — Twigs slender, pale-lenticellate, smooth, lustrous, light reddish brown, at length dark brown. Buds alternate, those near the branch-tip clustered about the terminal bud, broadly ovate, acute, dark reddish brown, somewhat pubescent. Mature bark dark brown, thin, divided by shallow furrows into irregular ridges, scaly at the surface.

Habitat — Prefers light sandy or gravelly soils in company with Red and Black Oak.

Range — Southern Maine west to southern Minnesota and eastern Nebraska, south to North Carolina and Nebraska. Zones A, **B**, and C.

Uses — The wood of this species is inferior to that of *Quercus rubra* but is put to the same uses. The tree is desirable ornamentally because of its beautiful foliage which turns scarlet in the autumn, but is subject to early decay resulting in windbreak.



Gray Oak

Quercus rubra, var. ambigua (Michx. f.) Fer. [Quercus borealis Michx. f.; Quercus ambigua Michx. f.; Quercus coccinea, var. ambigua Gray.]

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig x ½

FAGACEAE

Quercus rubra, var. ambigua (Michx. f.) Fer. [Quercus borealis Michx. f.; Quercus ambigua Michx. f.; Quercus coccinea, var. ambigua Gray.]

Gray Oak

Habit — Similar in habit to the Red Oak, *Quercus rubra* L. but never attaining to the maximum size of that species. A tree usually 50–60 feet in height with short, massive trunk, stout limbs and a broad, symmetrical, rounded crown.

Leaves — Similar to those of the Red Oak.

Flowers — Appearing in early June. Comparable to those of the Red Oak.

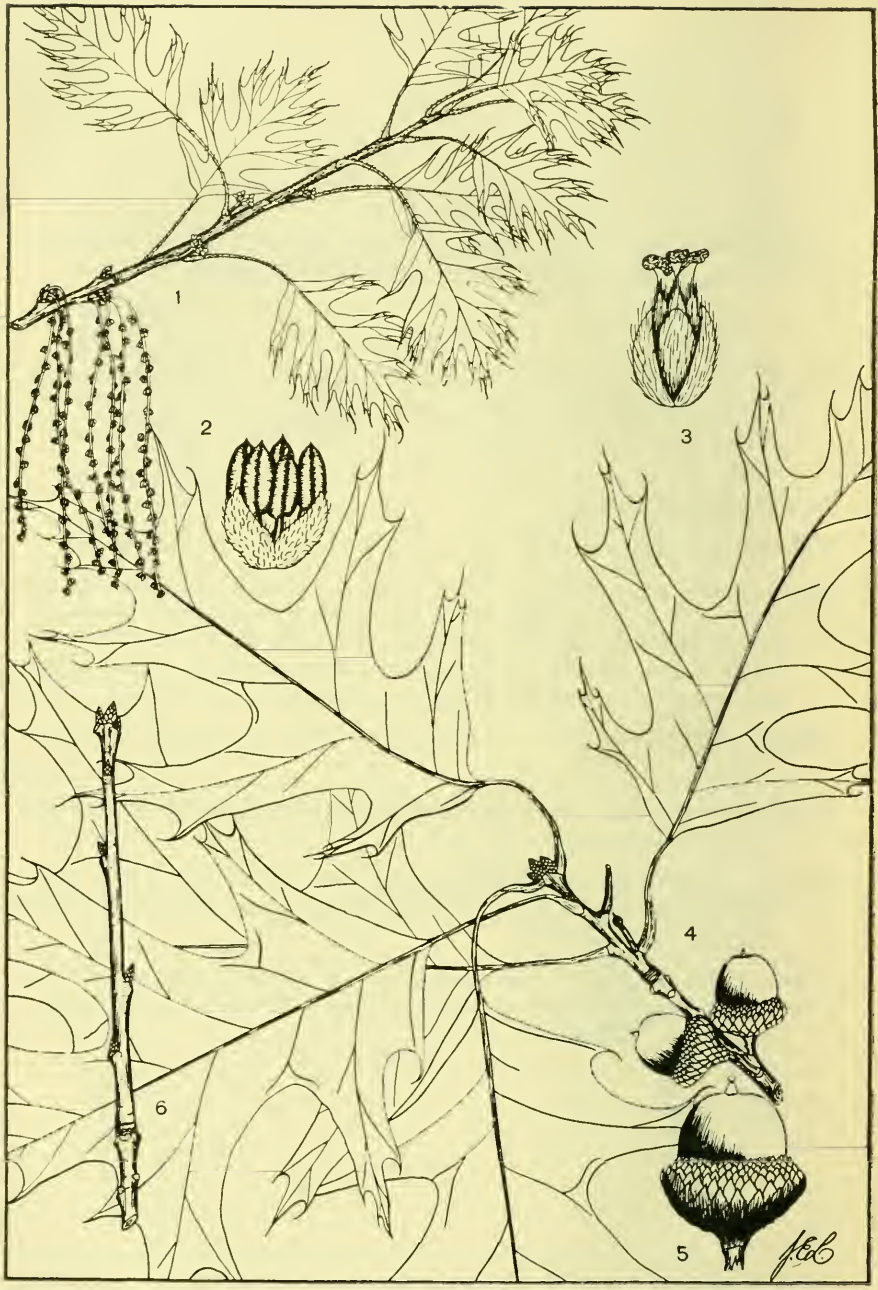
Fruit — Acorn approaching that of *Quercus coccinea* Muench. Nut oblong-ovoid to obovoid, chestnut-brown and lustrous at maturity, pointed at the apex, about 1 inch long, enclosed for one-fourth to one-third of its length in the cup. Cup turbinate or hemispheric, thick, reddish brown and pubescent within, reddish brown and nearly smooth without.

Winter characters — Not to be distinguished from Red Oak in the winter condition.

Habitat — An upland species preferring well-drained sites but not exacting as to soil requirements.

Range — Insufficiently known. Said to occur from Quebec and Ontario southward through New York and Pennsylvania but most common in our state along the northern border.

Uses — The wood is said to be stronger and more durable than that of Red Oak but is not distinguished from the wood of this species in the trade.



Black Oak, Yellow-bark Oak

Quercus velutina Lam. [Quercus tinctoria Bartr.; Quercus coccinea, var. tinctoria A. DC.]

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig x ½

FAGACEAE

Quercus velutina Lam. [Quercus tinctoria Bartr.; Quercus coccinea, var. tinctoria A. DC.]

Black Oak, Yellow-bark Oak

Habit — One of the commonest and most variable oaks of New York State. A tree usually 60–80 feet in height with a trunk diameter of 3–4 feet, in the lower Ohio basin sometimes 150 feet in height. Crown oblong, irregular, wide-spreading in the open with rather slender branches.

Leaves — Alternate, obovate to oblong, 4–6 inches long, 3–6 inches wide, acute at the apex, obtuse or truncate at the base, 5–7 lobed, the lobes repandly dentate and bristle-tipped and separated by deep, wide, rounded sinuses which extend over half way to the midrib. At maturity the leaves are thick, firm, glabrous, dark green and very lustrous above, and paler and pubescent beneath. Petioles stout, 2–6 inches long.

Flowers — Appearing in May and early June when the leaves are about one-third grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 4–6 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx campanulate, reddish green, pubescent, deeply cut into 4 ovate, acute lobes. Stamens 4, exserted, with yellow, apiculate anthers. Pistillate flowers in groups of 2–3 (occasionally solitary) on short tomentose peduncles, borne in the axils of the leaves of the season, each subtended by the ovate, hairy involucral scales. Calyx campanulate, adnate to the ovary, the lobes acute and hirsute. Pistil consisting of a 3-celled (rarely 4–5 celled) ovary surmounted by 3 ascending red styles stigmatic on the inner surface.

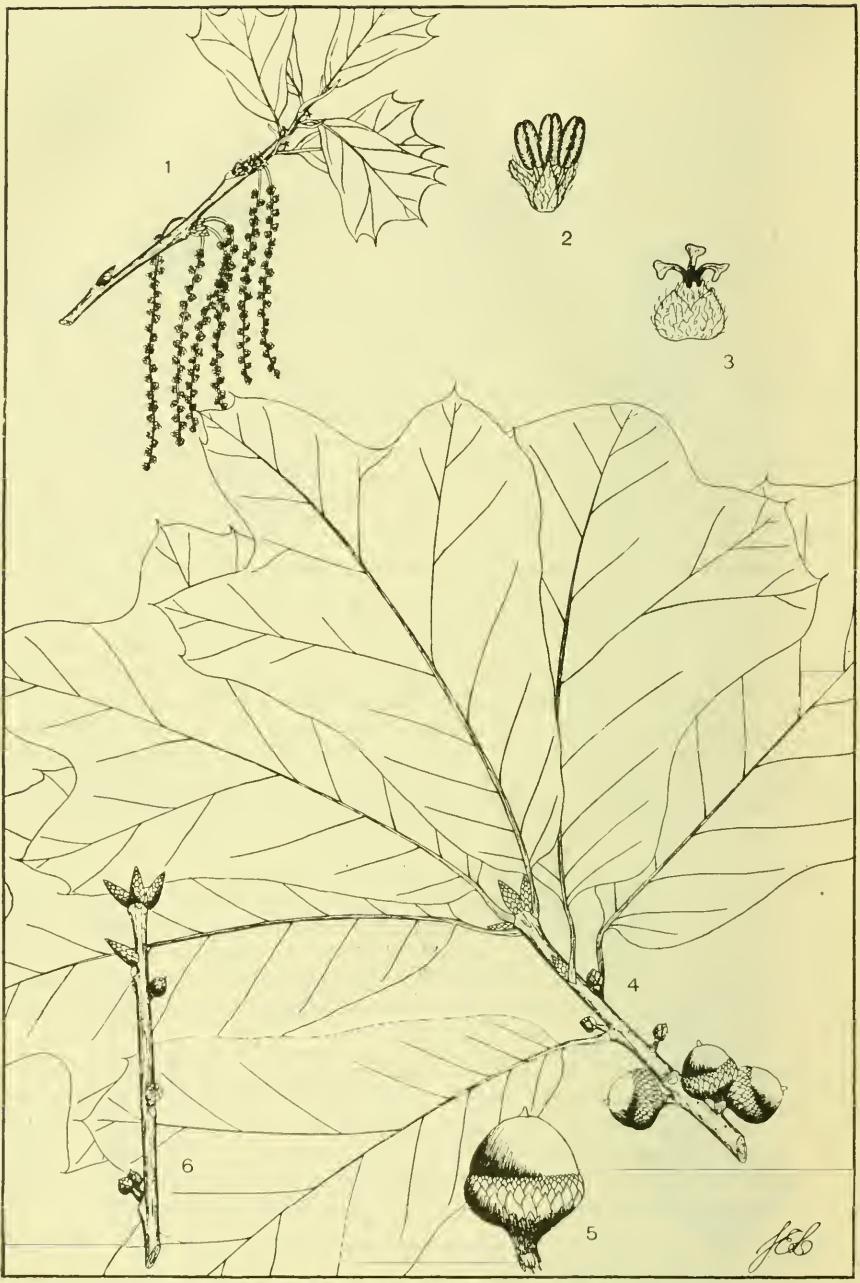
Fruit — An acorn, borne solitary or in pairs, sessile or on a short, stout peduncle, ripening the second season. Nut ovate to oval, reddish brown, often striate and pubescent at maturity, round-pointed at the apex, ½–¾ of an inch long, enclosed for about half of its length in the cup. Cup thin, turbinate, dark reddish brown and puberulous within, pale hoary and chestnut-brown without, the ovate acute scales with free scarious tips toward the top.

Winter characters — Twigs stout, pale-lenticellate, smooth or sparingly pubescent, dull reddish brown, at length dark brown. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, acute, yellowish gray, pubescent, ¼–½ of an inch long. Mature bark dark brown or nearly black, thick, rough, divided by deep fissures into broad, rounded ridges, scaly at the surface. Inner bark orange-colored.

Habitat — An upland species preferring well-drained sites on ridges, hills and dry plains. Thrives on poor soils.

Range — Southern Maine westward through Ontario to central Minnesota and eastern Nebraska, south to Florida, and eastern Texas. Zones A, **B**, and C.

Uses — Of little importance as a timber species. Wood hard, heavy, strong, coarse-grained, light reddish brown with paler sapwood. Largely used for fuel. A yellow dye (quercitron) may be obtained from the inner bark.



Black Jack Oak, Barren Oak

Quercus marilandica Muench.

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig x ½

FAGACEAE

Quercus marilandica Muench.

Black Jack Oak, Barren Oak

Habit — A small tree usually 20–40 feet in height with a trunk diameter of 6–12 inches, under favorable conditions sometimes 40–50 feet tall. Crown in the open narrow and round-topped with wide-spreading and somewhat pendulous branches, much restricted under forest conditions.

Leaves — Alternate, obovate, rounded or cordate at the base, 3- (rarely 5-) lobed at the apex, the lobes rounded or acute, entire, or dentate and bristle-tipped. At maturity the leaves are thick, firm, dark green and lustrous above, and rusty brown and pubescent below. Petioles stout, ½–¾ of an inch long.

Flowers — In our range appearing in May when the leaves are about one-fourth grown, monoecious. Staminate flowers in interrupted, filiform, pendulous, hairy aments 2–4 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx campanulate, reddish green, pubescent, deeply divided into 4–5 broad, ovate, rounded lobes. Stamens 4–5, with oblong, apiculate, glabrous, dark red anthers. Pistillate flowers solitary or paired, pedunculate, borne in the axils of the leaves of the season, each subtended by the broadly ovate, rusty-tomentose involucral scales. Calyx adnate to the ovary, its lobes shallow and acute. Stigmas spatulate, reflexed, dark red.

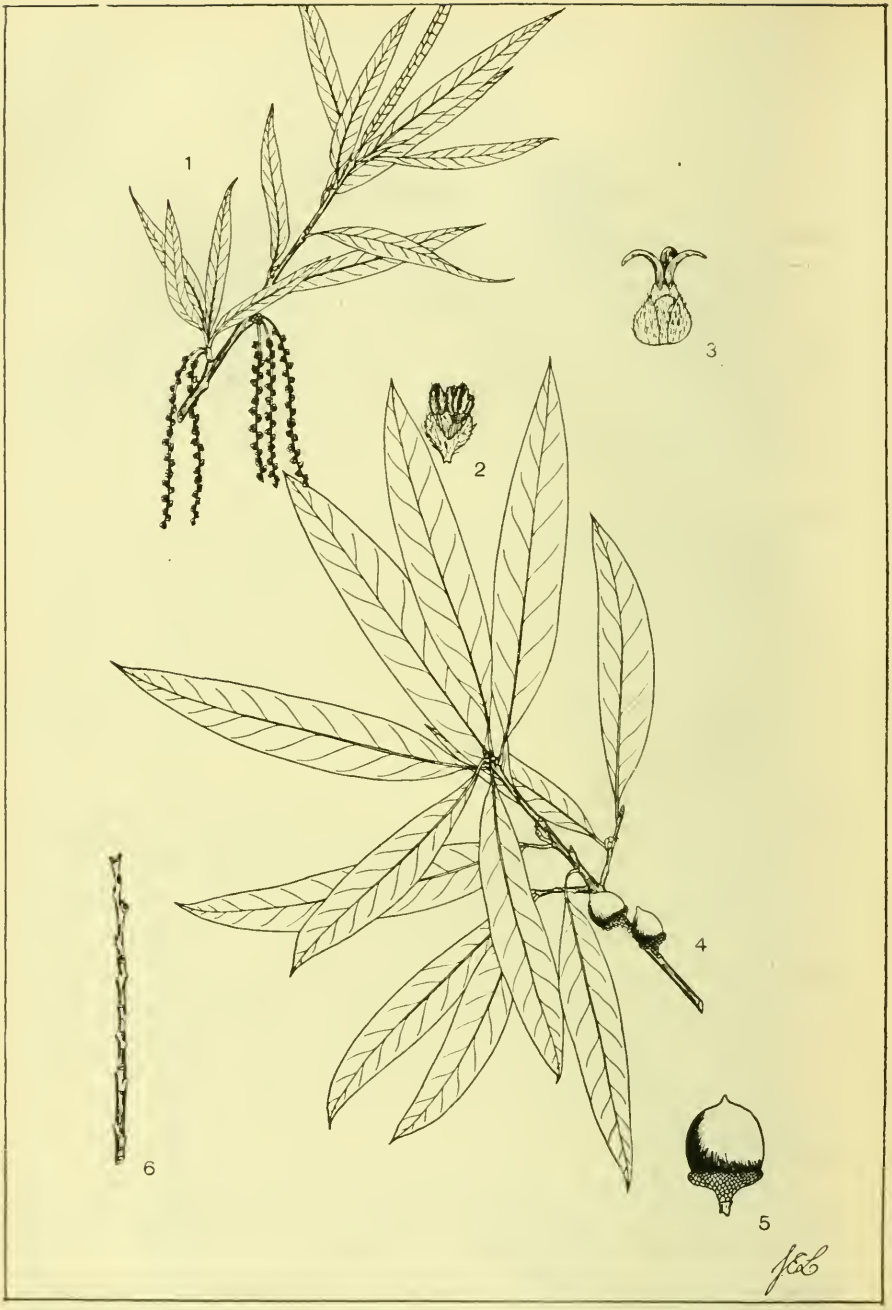
Fruit — An acorn, borne solitary or in pairs on stout peduncles, ripening the second season. Nut ovoid, pale chestnut-brown and often striate, round-pointed at the apex, ⅝–¾ of an inch long, enclosed for about half of its length in the cup. Cup turbinate, thick, pale brown and puberulous within, reddish brown without, its scales tomentose and loosely imbricated.

Winter characters — Twigs stout, pale-lenticellate, smooth or puberulous, reddish brown, at length dark brown or gray. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, acute-angled, pubescent, reddish brown, about ¼ of an inch long. Mature bark dark brown or black, thick, rough with deep fissures separating squarish plates 1–3 inches in diamter.

Habitat — In our range a tree of the sand barrens, preferring dry, sterile soils where conditions are adverse for most tree species.

Range — Long Island west through Pennsylvania to southeastern Nebraska, south to Florida, and eastern Texas. Zone A.

Uses — The tree is of no commercial value in New York State. Wood hard, heavy, strong, dark brown with paler sapwood. In the south it is used for fuel, railroad ties, and occasionally manufactured into lumber.



Willow Oak

Quercus phellos L.

1. A twig showing pistillate and staminate flowers, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A twig showing mature leaves and fruit x ½
5. Nut with cup, lateral view x 1
6. Winter twig x ½

FAGACEAE

Quercus phellos L.

Willow Oak

Habit — A tree under optimum forest conditions occasionally 70–80 feet in height with a trunk diameter of 2–4 feet and a restricted crown. In the open the trees are usually 50–60 feet tall at maturity with narrow, usually open, round-topped pyramidal crowns.

Leaves — Alternate, linear-lanceolate to linear-oblong, 2–5 inches long, ½–1 inch wide, sharply acute and bristle-pointed at the apex, acute at the base, entire or slightly undulate and revolute on the margin, at maturity thick, firm, light green, glabrous and lustrous above, paler and smooth or rarely pubescent below, borne on stout petioles ⅛–¼ of an inch long.

Flowers — In New York State appearing in May when the leaves are about one-fourth grown, monoecious. Staminate flowers in interrupted filiform, pendulous, hairy aments 2–3 inches long which are borne on the growth of the preceding season or from the axils of the inner scales of the terminal bud. Calyx campanulate, yellow, pubescent, deeply cut into 4–5 ovate, acute lobes. Stamens 4–5, the anthers oblong, hairy, slightly apiculate. Pistillate flowers solitary or paired, pedunculate, borne in the axils of the leaves of the season, each subtended by the broadly ovate, brown, hairy involucral scales. Calyx adnate to the ovary, the lobes shallow and acute. Styles elongated, spreading, strap-shaped, bright red, stigmatic on the inner surface.

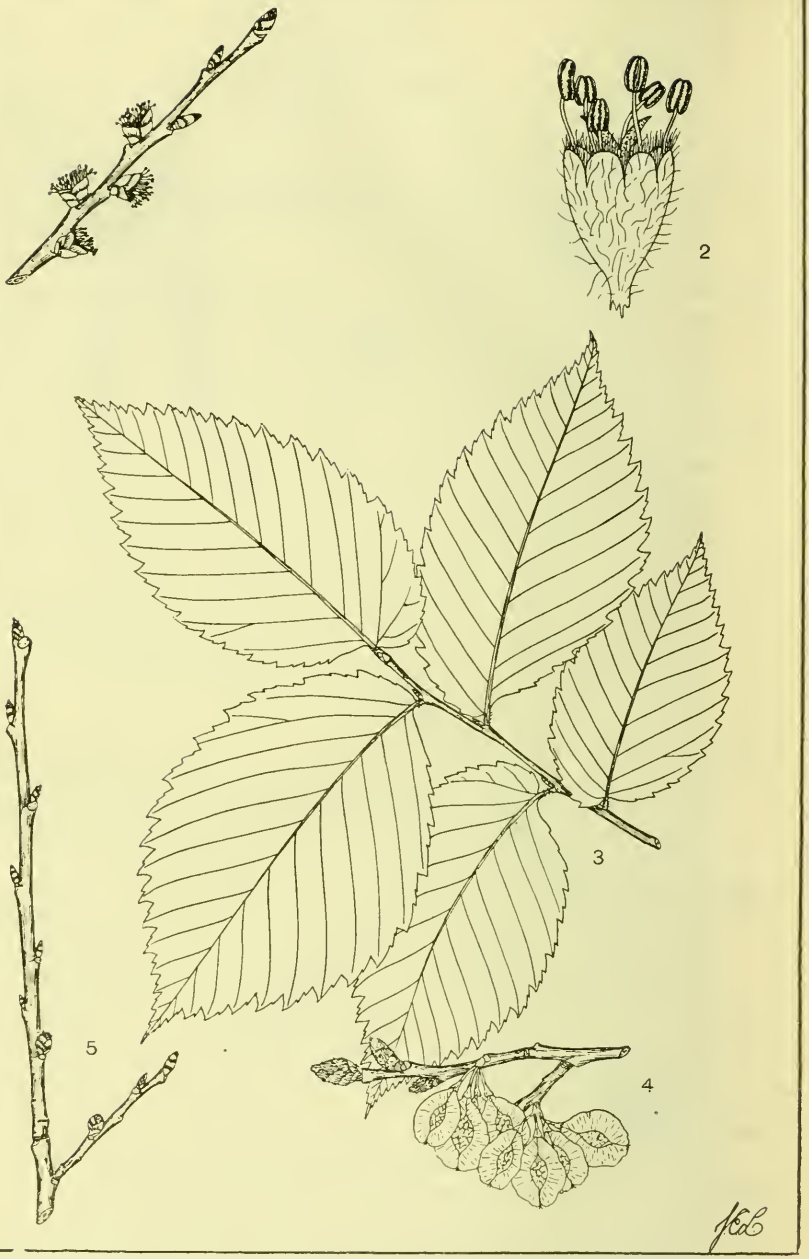
Fruit — An acorn, borne solitary or in pairs, sessile or short-pedunculate, ripening the second season. Nut globose or globose-ovoid, pale yellowish brown and pubescent at maturity, round-pointed at the apex, about ⅜ of an inch long. Cup saucer-shaped, thin, silky-pubescent within, reddish brown and pubescent without.

Winter characters — Twigs slender, dark-lenticellate, glabrous, lustrous, reddish brown, at length dark reddish or grayish brown. Buds alternate, those near the branch-tip clustered about the terminal bud, ovate, acute, chestnut-brown, about ⅛ of an inch long. Mature bark reddish brown, thin, divided by shallow fissures into irregular plates, scaly on the surface.

Habitat — Chiefly a bottom-land species preferring moist sites along stream courses and swamp borders, more rarely in well-drained. sandy, upland situations.

Range — Staten Island, N. Y., south through the maritime belt to Florida, west through the Gulf states to eastern Texas, northward to southern Missouri, western Tennessee and Kentucky. Zone A.

Uses — Not an important timber species. Wood medium hard, heavy, strong, coarse-grained, pale reddish brown with lighter sapwood. Used locally for construction, railroad ties and wagonry. The importance of the species lies more in its value as an ornamental and shade tree.



Slippery Elm, Red Elm

Ulmus fulva Michx. [Ulmus pubescens Walt.]

1. A twig showing flowers and leaf-buds x ½
2. A flower, lateral view x 4
3. A twig with mature leaves x ½
4. A twig with fruit and leaf-buds x ½
5. Winter twig x ½

ULMACEAE

Ulmus fulva Michx. [Ulmus pubescens Walt.]

Slippery Elm, Red Elm

Habit — A medium-sized tree, usually 40–60 feet in height with a trunk diameter of 1–2½ feet, occasionally under optimum conditions 80 feet tall. Bole usually short, soon breaking up into a number of large, spreading limbs to form a broad, open, flat-topped head.

Leaves — Alternate, oval to obovate, 5–7 inches long, 2–3 inches wide acuminate at the apex, rounded and inequilateral at the base, coarsely doubly serrate, at maturity thick, firm, dark green and rough papillose with impressed veins above, pale dense white-hairy below, borne on stout, pubescent petioles about ⅛ of an inch long.

Flowers — Perfect, short pedicellate, appearing before the leaves during April and early May in short pedunculate, 3-flowered inflorescences from the axils of the inner scales of separate flower buds, each bud giving rise to a globose cluster. Calyx campanulate, green, pale-hairy, 5–9-lobed, the lobes short and rounded. Stamens as many as the corolla lobes, exserted, with slender, pale yellow filaments and red anthers. Pistil consisting of a compressed, 2-celled ovary surmounted by 2 reddish purple, divergent styles stigmatic along their inner margin.

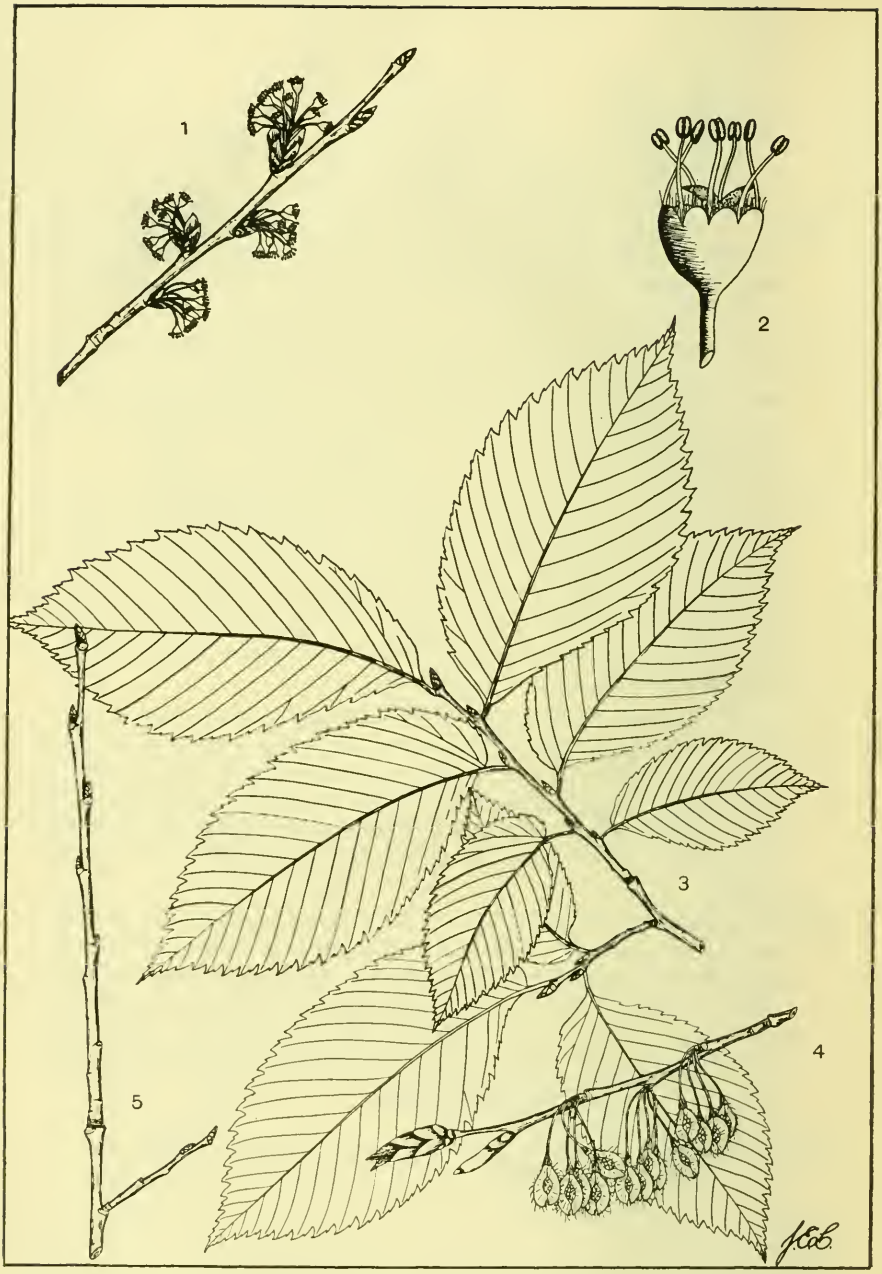
Fruit — A 1-seeded, oval-orbicular, short-stalked, pale green samara, ½–¾ of an inch long, marked by a horizontal line indicating the union of the 2 carpels, smooth aside from a rusty-tomentose area on the face over the seminal cavity, ripening when the leaves are about half grown. Wing broad, slightly emarginate at the apex of the fruit, rounded or somewhat wedge-shaped at the base, naked on the margin, obscurely reticulate veined.

Winter characters — Twigs stout, somewhat scabrous, roughened by the raised lenticels and leaf-scars, pale pubescent, ashy gray to grayish brown, at length dark grayish brown. Terminal bud absent. Leaf-buds toward the end of twig, ovate, bluntly acute, rusty-tomentose, dark chestnut-brown, about ¼ of an inch long. Flower buds stouter and thicker than the leaf-buds, situated farther back on the twig. Mature bark thick, rough, shallowly fissured, ashy gray to dark reddish brown. Inner bark pale white, fragrant, strongly mucilaginous.

Habitat — Stream banks and low fertile slopes, preferring deep, rich soils. Thrives on limestone outcrops.

Range — Southern Canada, west to North Dakota, south to Florida and Texas. Zones A, B, and C.

Uses — Not an important timber species. Wood hard, heavy, strong, coarse-textured, dark reddish brown with paler sapwood, durable in contact with the soil. Used for fence posts, railroad ties, slack cooperage, wheel hubs and agricultural implements. The mucilaginous inner bark is of value medicinally.



White Elm, American Elm

Ulmus americana L.

1. A twig showing flowers and leaf-buds x ½
2. A flower, lateral view x 4
3. A twig showing mature leaves x ½
4. A twig showing fruit and unfolding leaf-buds x ½
5. Winter twig x ½

ULMACEAE

Ulmus americana L.

White Elm, American Elm

Habit — The largest of the elms. A tree usually 60–100 feet in height with a trunk diameter of 2–5 feet, under optimum conditions sometimes 140 feet tall with a crown spread of 50–70 feet. In the open the crown is very variable. Well known varieties are the vase form, the umbrella form and the feathered form. Bole tall and straight, bearing a high crown of graceful, drooping branches, or short and often buttressed at the base and soon breaking up into large, ascending limbs.

Leaves — Alternate, oval to obovate-oblong, 4–6 inches long, 1–3 inches wide, acuminate at the apex, rounded and inequilateral at the base, coarsely doubly serrate, at maturity dark green and glabrate and slightly scabrous above, paler and soft pubescent or quite glabrous below, with prominent midrib and parallel secondary veins, borne on stout petioles about ¼ of an inch long.

Flowers — Perfect, pedicellate, appearing before the leaves during April and May in long pedunculate, 3–4 flowered inflorescences from the axils of the inner scales of separate flower-buds, each bud giving rise to 5–8 fascicles. Calyx campanulate, reddish green, puberulous, 7–9-lobed, the lobes short, rounded and ciliate on the margins. Stamens as many as the corolla lobes, exserted, with slender filaments and red anthers. Pistil with light green, compressed, 2-celled ovary surmounted by 2 green styles white papillate along the inner surface.

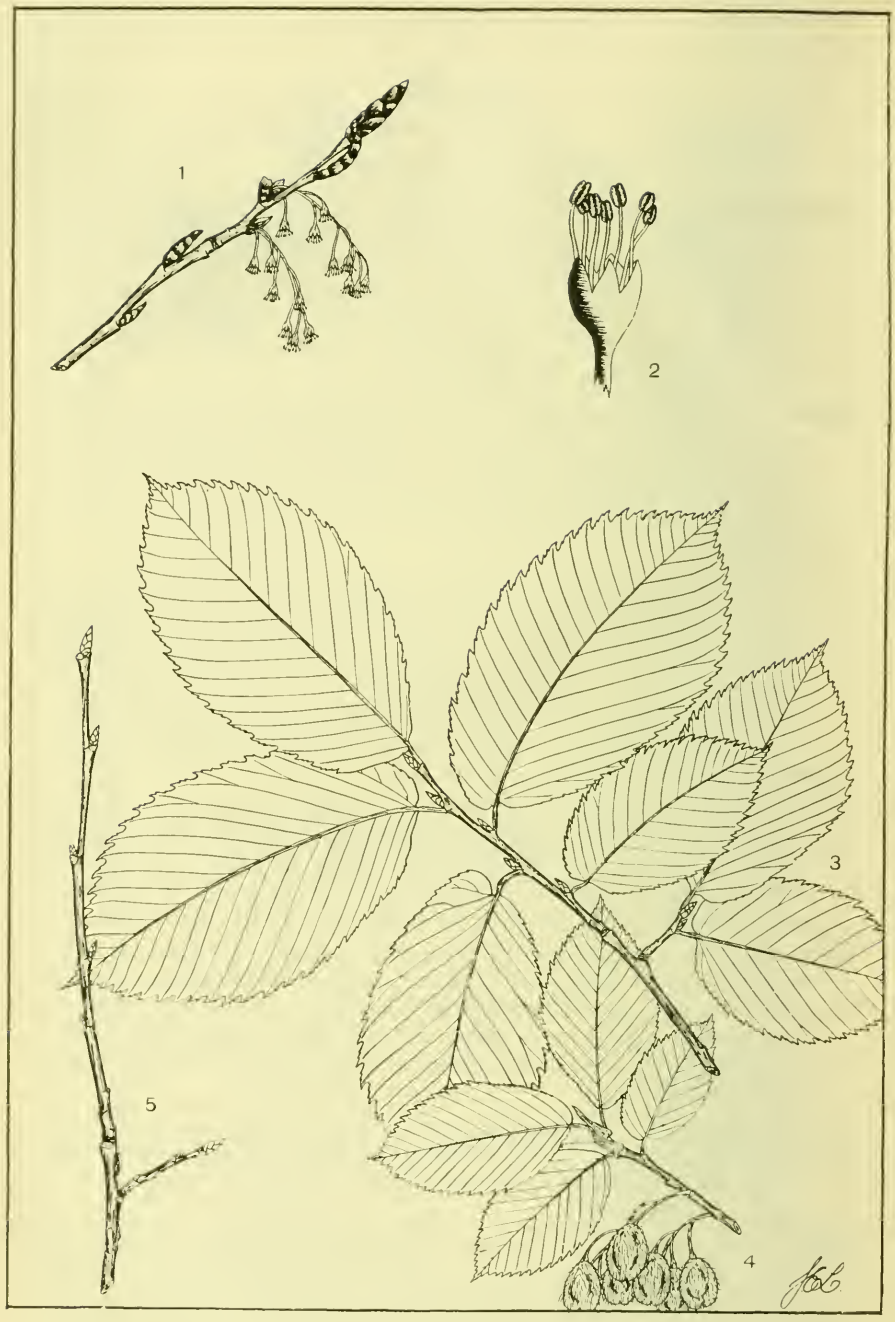
Fruit — A 1-seeded, oval to obovate-oblong, long-stalked, pale green samara, about ½ of an inch long, marked by a horizontal line indicating the union of the 2 carpels, smooth aside from the ciliate margin, ripening as the leaf-buds begin to unfold. Wing reticulate-venulose, ciliate on the margin, deeply notched at the apex, the teeth incurved and overlapping.

Winter characters — Twig slender, lenticellate, glabrous or puberulous, light reddish brown, at length dark brown or ashy-gray. Terminal bud absent. Leaf-buds ovate, acute, chestnut-brown, about ⅛ of an inch long. Flower-buds slightly larger, borne below the leaf-buds. Mature bark thick, rough, ashy-gray, irregularly divided by deep fissures into broad, scaly ridges.

Habitat — Typically a bottom-land species, preferring moist, rich alluvial soils along stream courses and lakes but thriving well on upland sites, usually in admixture with other species. Not exacting as to soil requirements.

Range — Newfoundland west through southern Canada to the eastern slopes of the Rocky Mountains, south to Florida and eastern Texas. The most widely distributed of the American elms. Zones **B**, **C**, and D.

Uses — A valuable species. Wood heavy, hard, strong, coarse-grained, tough, difficult to split, light brown with wide, paler sapwood. Widely used for cheese boxes, cooperage, and a variety of purposes including planking, wheel hubs, etc. The tree with its various forms is valuable as a shade and ornamental species along avenues and highways.



Rock Elm, Cork Elm

Ulmus racemosa Thomas [Ulmus Thomasi Sarg.]

1. A twig showing flowers and leaf-buds x ½
2. A flower, lateral view x 4
3. A twig showing mature leaves x ½
4. A twig showing fruit and immature leaves x ½
5. Winter twig x ½

ULMACEAE

Ulmus racemosa Thomas [Ulmus Thomasi Sarg.]

Rock Elm, Cork Elm

Habit — A tree usually 50–80 feet in height with a trunk diameter of 2–3 feet, occasionally under optimum conditions 100 feet tall with a trunk 4–5 feet through. In the open the crown is narrowly oblong and round-topped, consisting of numerous short, slender branches, those near the base drooping and extending to within 6–8 feet of the ground. Bole continuous into the crown, under forest conditions sometimes free of branches for 40–60 feet.

Leaves — Alternate, oblong-oval to obovate, 2–2½ inches long, ¾–1 inch wide, abruptly acuminate at the apex, rounded and inequilateral at the base, coarsely doubly serrate, at maturity thick, firm, smooth, dark green and lustrous above with prominent midrib and secondary veins, pale pubescent beneath, borne on stout petioles about ¼ of an inch long.

Flowers — Perfect, long-pedicellate, appearing before the leaves during April and early May in long-pedunculate, puberulous, 2–4-flowered racemose cymes from separate flower-buds. Calyx campanulate, green, divided nearly to the middle into 7–8 rounded, dark red lobes. Stamens as many as the corolla lobes, exserted, with slender, pale green filaments and purple anthers. Pistil consisting of a compressed, pale-hairy, 2-celled ovary surmounted by 2 green styles stigmatic along their inner margin.

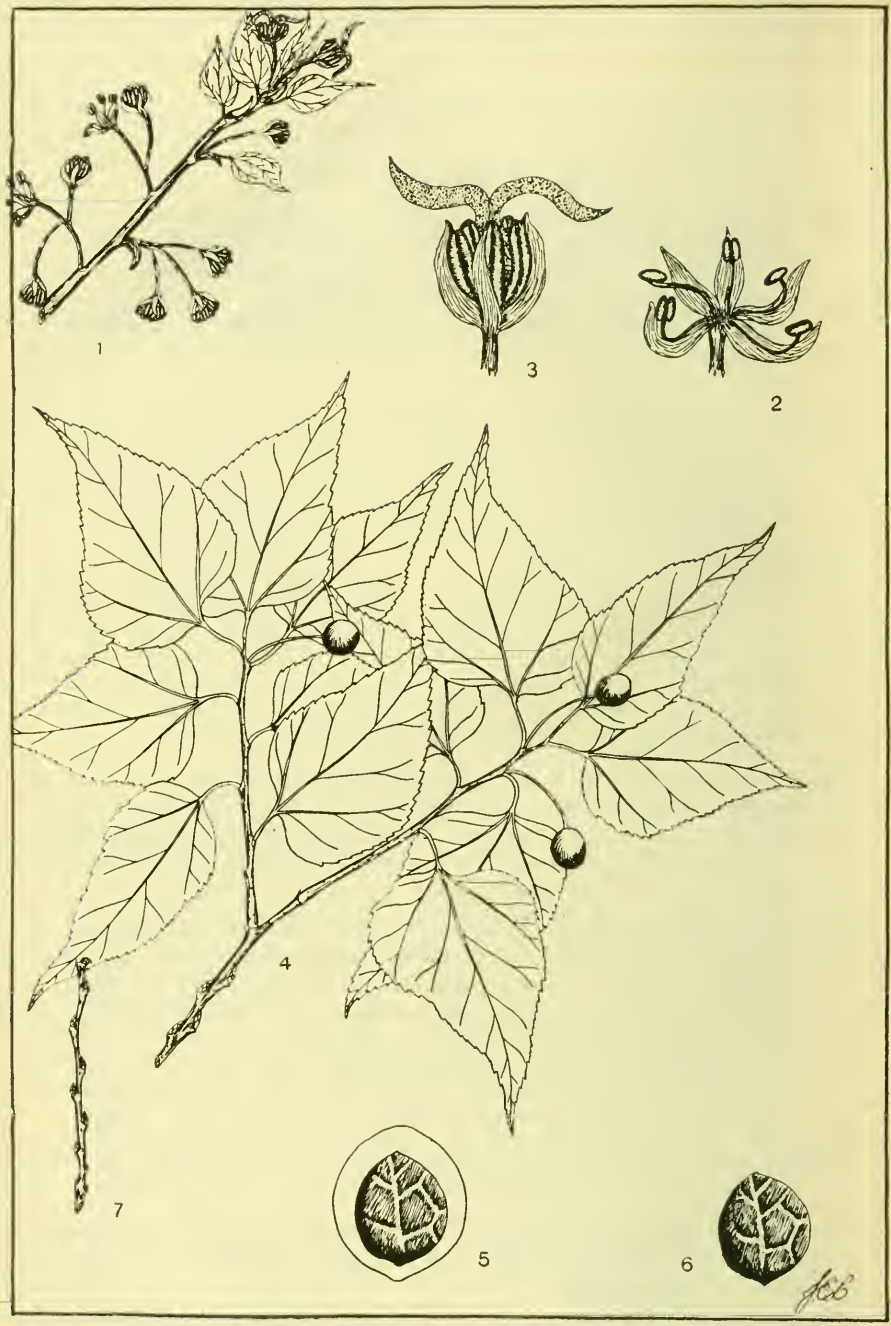
Fruit — A 1-seeded, oval to obovate-oblong, long-stalked, pale green samara, about ½ of an inch long, pubescent, ciliate on the margin, ripening when the leaves are about half grown. Wing broad, shallowly notched at the apex of the fruit, obscurely veined, somewhat thickened and ciliate at the border.

Winter characters — Twigs slender, lenticellate, glabrous and lustrous or puberulous, light reddish brown, at length dark brown or ashy-gray and often corky-ridged. Terminal bud absent. Leaf-buds inserted near the end of the twig, ovate, sharply acute, about ¼ of an inch long, the scales chestnut-brown with ciliate margins. Flower-buds occasionally bearing 1–2 small leaves, similar but slightly larger than the leaf-buds, borne below the leaf-buds on the twig. Mature bark thick, rough, grayish brown, divided by deep fissures into broad, flat ridges, scaly at the surface.

Habitat — Prefers dry stony uplands, especially limestone outcrops, but thrives on heavier, poorly drained clay soils.

Range — Southern Quebec westward through southern Ontario, central Michigan and Wisconsin, to Nebraska, southward to Tennessee and Missouri. Zones B and C.

Uses — Wood hard, heavy, strong, coarse-grained, tough, difficult to split, light brown with wide, paler sapwood. Considered superior to that of the other American elms. Used for planks, bridge construction, cheese boxes, wheel hubs, agricultural implements, and railroad ties.



Hackberry, Sugarberry

Celtis occidentalis L. [Celtis canina Raf.]

1. A twig showing polygamous flowers and immature leaves x 1
2. An expanded staminate flower, lateral view x 3
3. A perfect flower, lateral view x 3
4. A twig showing mature leaves and fruit x ½
5. Fruit, lateral sectional view x 2
6. Rugose nutlet, lateral view x 2
7. Winter twig x ½

ULMACEAE

Celtis occidentalis L. [Celtis canina Raf.]

Hackberry, Sugarberry

Habit — In our range usually, a small tree 20–60 feet in height with a trunk diameter of ½–2 feet, attaining its maximum size of 130 feet in the rich alluvial soils of the Ohio basin. In the open the trunk is short, breaking up 8–10 feet above the ground into stout spreading limbs to form a bushy, ovoid or oblong, round-topped head comparable to that of the Sugar Maple.

Leaves — Alternate, broadly ovate and somewhat falcate, 2½–4 inches long, 1–2 inches wide, acuminate at the apex, rounded and inequilateral at the base, coarsely serrate except at the ends, 3-ribbed, at maturity thin, lustrous, smooth or scabrous and light green with sunken veins above, paler and glabrous or somewhat hairy on the prominent veins beneath, borne on slender, hairy petioles ½–⅔ of an inch long.

Flowers — Appearing in May with the leaves, polygamo-monoecious, the staminate cymose from flower-buds at the base of the growth of the season, the perfect and pistillate solitary or in few-flowered fascicles from the axils of the upper leaves. Calyx pale yellowish green, divided nearly to the base into 5 linear, acute, scarious lobes. Stamens in sterile flower inserted marginally on the white-tomentose receptacle. Filaments incurved above the middle before anthesis, bearing proximal, oblong, emarginate anthers, straightening abruptly and catapulting the pollen as the flower opens. Stamens in perfect flower shorter with slightly curved filaments and anthers equal to or slightly exceeding the calyx-lobes, similar in anthesis. Pistil consisting of a sessile, green, lustrous, 1-celled, ovate ovary surmounted by a short, sessile style dividing into 2 broadly divergent lobes white papillate and stigmatic on their inner surface.

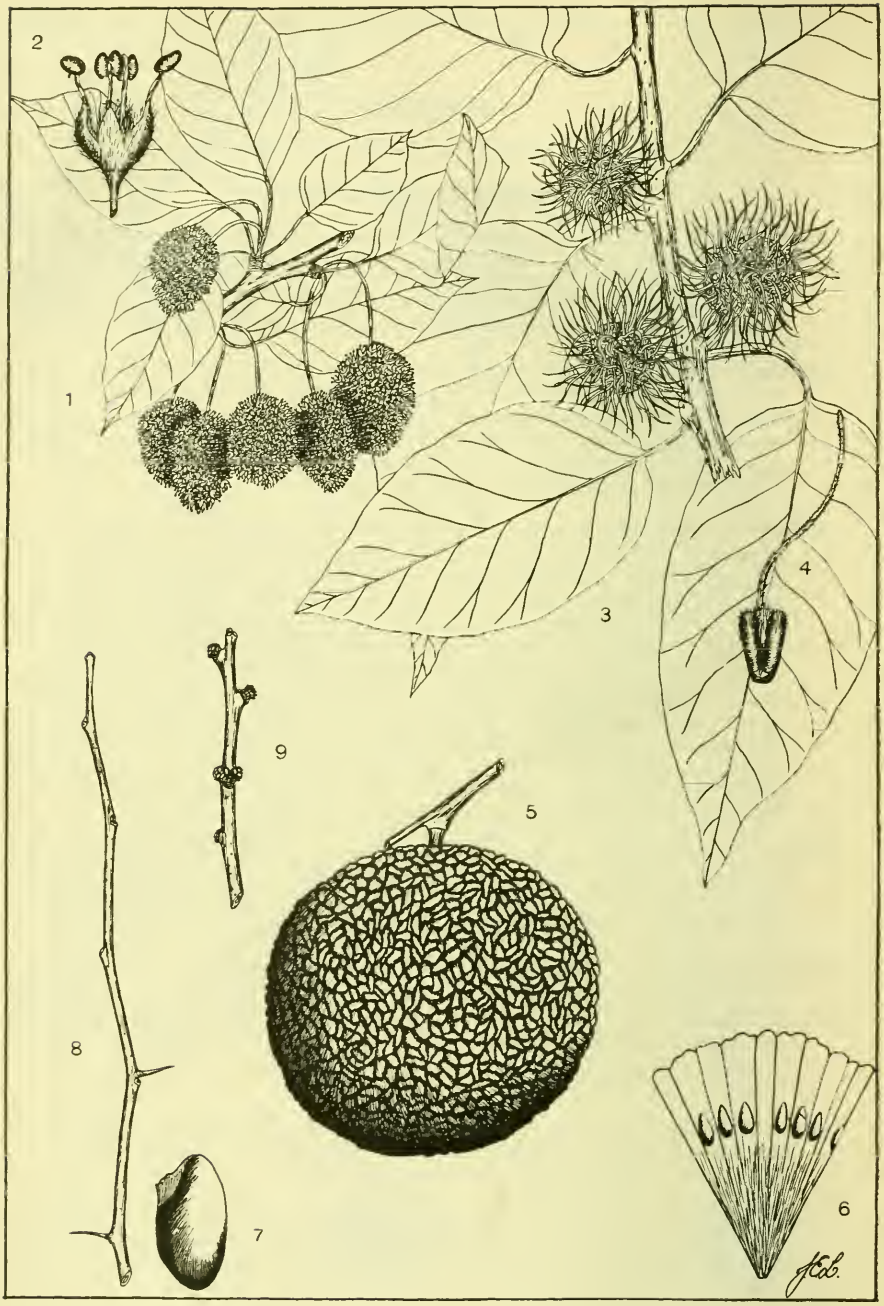
Fruit — A thick-skinned, 1-seeded, subglobose or oblong, long-stalked, dark purple, dry drupe, about ¼ of an inch long, tipped by the persistent style, maturing in the autumn and persisting into the winter. Flesh thin, dry, orange-colored. Nutlet oblong-oval, thick-walled, apiculate, light brown.

Winter characters — Twigs slender, somewhat zigzag, glabrous or puberulous, semi-lustrous, reddish brown, at length dark reddish brown. Terminal bud absent. Lateral buds ovate, acute, closely appressed and flattened, pubescent, chestnut-brown, about ¼ of an inch long. Mature bark thick, grayish brown, scaly at the surface, often roughened by characteristic, irregular, wart-like excrescences.

Habitat — Attains its best development in the deep alluvial soils of river bottoms but thrives on gravelly and stony upland sites, especially limestone outcrops. Widely scattered and usually solitary.

Range — Southern Quebec, westward to eastern Washington and Oregon, southward to Florida, eastern Texas, New Mexico and Nevada. Rare and widely scattered in the east through the agency of birds. Zones A, B, and C.

Uses — Of no economic importance in New York State because of its scarcity. Wood rather soft, heavy, not strong, coarse-grained, pale yellow with wide sapwood. Used for cheap furniture, boxes, slack cooperage and fencing.



Osage Orange

Maclura pomifera (Raf.) Schn. [Toxylon pomiferum Raf.; Maclura aurantiaca Nutt.]

1. A twig showing staminate flowers and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A twig showing pistillate flowers and immature leaves x ½
4. A pistillate flower, lateral view x 4
5. Portion of a twig with fruit x ½
6. Section of fruit showing seeds x ½
7. Seed, lateral view x 2
8. Twig with short lateral spurs x ½
9. Vigorous twig with lateral spines x ½

MORACEAE

Maclura pomifera (Raf.) Schn. [Toxylon pomiferum Raf.; Maclura aurantiaca Nutt.]

Osage Orange

Habit — A tree of medium size, within its natural range sometimes 50–60 feet in height with a trunk diameter of 2–3 feet, in New York State usually much smaller, often a large shrub. Trunk short, dividing a few feet from the ground into stout, ascending branches, the lower arching to form an open, rather irregular, round-topped head.

Leaves — Alternate, narrowly ovate to oblong-lanceolate, 3–5 inches long, 2–3 inches wide, acuminate at the apex, rounded or somewhat cordate at the base, entire, at maturity thick, firm, dark green and lustrous above, paler, dull and slightly pubescent on the midribs below, borne on slender pubescent petioles 1½–2 inches long which exude a milky juice when broken.

Flowers — Appearing during May and June when the leaves are about two-thirds grown, dioecious, the staminate in stout, globose, long-stalked racemes from the axils of the leaves crowded on short spurs, the pistillate sessile in short-stalked, dense, globose, many-flowered heads axillary on shoots of the year. Staminate flower slender-pedicelled. Calyx campanulate, pubescent without, divided to the middle into 4 acute lobes. Stamens 4, inserted opposite the calyx-lobes, becoming exserted abruptly at anthesis. Calyx of pistillate flower obovate, pubescent above, cleft to the base into 4 oblong, thick, concave lobes which are longer than the ovary and closely invest it, becoming fleshy and persisting in the fruit. Pistil consisting of an ovate, sessile, flattened, glabrous, green ovary surmounted by a long filiform style covered with white stigmatic hairs.

Fruit — A multiple, short-stalked, spherical, yellowish green syncarp, 4–5 inches in diameter sculptured on the surface by the persistent, fleshy perianth-tips, enclosing in its milky pulp the oblong, compressed, pale chestnut-brown seeds.

Winter characters — Twigs stout, tough, flexible, smooth, pale orange-brown, the more vigorous armed with stout, straight, axillary spines, the older twigs unarmed but bearing short, spur-like branches. Pith thick, orange-colored. Terminal bud absent. Lateral buds alternate, blunt, small, pale chestnut-brown and ciliate, partly immersed in the bark. Mature bark thick, dark orange-colored, deeply furrowed.

Habitat — In its natural range, preferring rich moist bottom-lands. Grown in the east under a variety of conditions as a hedge plant.

Range — Southern Arkansas and Oklahoma south into northern Louisiana and eastern Texas. Extensively planted in eastern United States as a hedge plant. Zones B and C.

Uses — Of no commercial importance in New York State. Wood heavy, very hard and strong, coarse-grained, durable, bright orange on fresh section with thin, pale sapwood. Used for fence posts, railroad ties, wheel hubs, and as a source of a yellow dye. The tree makes a good hedge plant if kept trimmed.

Paper Mulberry

Broussonetia papyrifera (L.) Vent. [Morus papyrifera L.; Papyrius papyrifera (L.) Kuntze.]

1. A twig showing staminate aments and immature leaves x ½
2. A staminate flower, lateral view x 7
3. A twig showing heads of pistillate flowers and immature leaves x ½
4. A pistillate flower, lateral view x 7
5. A twig showing mature leaves and fruit x ½
6. A druplet subtended by persisting calyx x 5
7. Druplet, lateral view x 10
8. Winter twig x ½

MORACEAE

Broussonetia papyrifera (L.) Vent. [Morus papyrifera L.; Papyrius papyrifera (L.) Kuntze.]

Paper Mulberry

Habit — A small or medium-sized tree 30–50 feet in height with a trunk diameter of 1–4 feet. Bole stout, in age often oddly gnarled and convoluted. Crown wide-spreading, round-topped, consisting of many rather stout, densely hairy branches. Spreads freely by root-suckers.

Leaves — Alternate, broadly ovate to oval, 3–8 inches long, acuminate at the apex, rounded or cordate at the base, serrate, dentate on the margin or mitten-shaped or 3-lobed with oblique sinuses which are rounded or jagged at the bottom, at maturity dark green, dull and scabrous above, paler and velvety-tomentose below, borne on pubescent, terete petioles 2–4 inches long which exude a milky juice when broken.

Flowers — Appearing in May or early June when the leaves are partly grown, inconspicuous, dioecious, the staminate in cylindrical, stalked, nodding aments, the pistillate in dense, globose heads. Calyx of staminate flower pubescent without, deeply 4-cleft, its lobes ovate, rounded and spreading. Stamens 4, exserted, inserted opposite the lobes of the calyx. Rudimentary ovary present. Calyx of pistillate flower tubular, enclosing a stalked ovary which bears an exserted, laterally inserted, filiform style and terminal stigma.

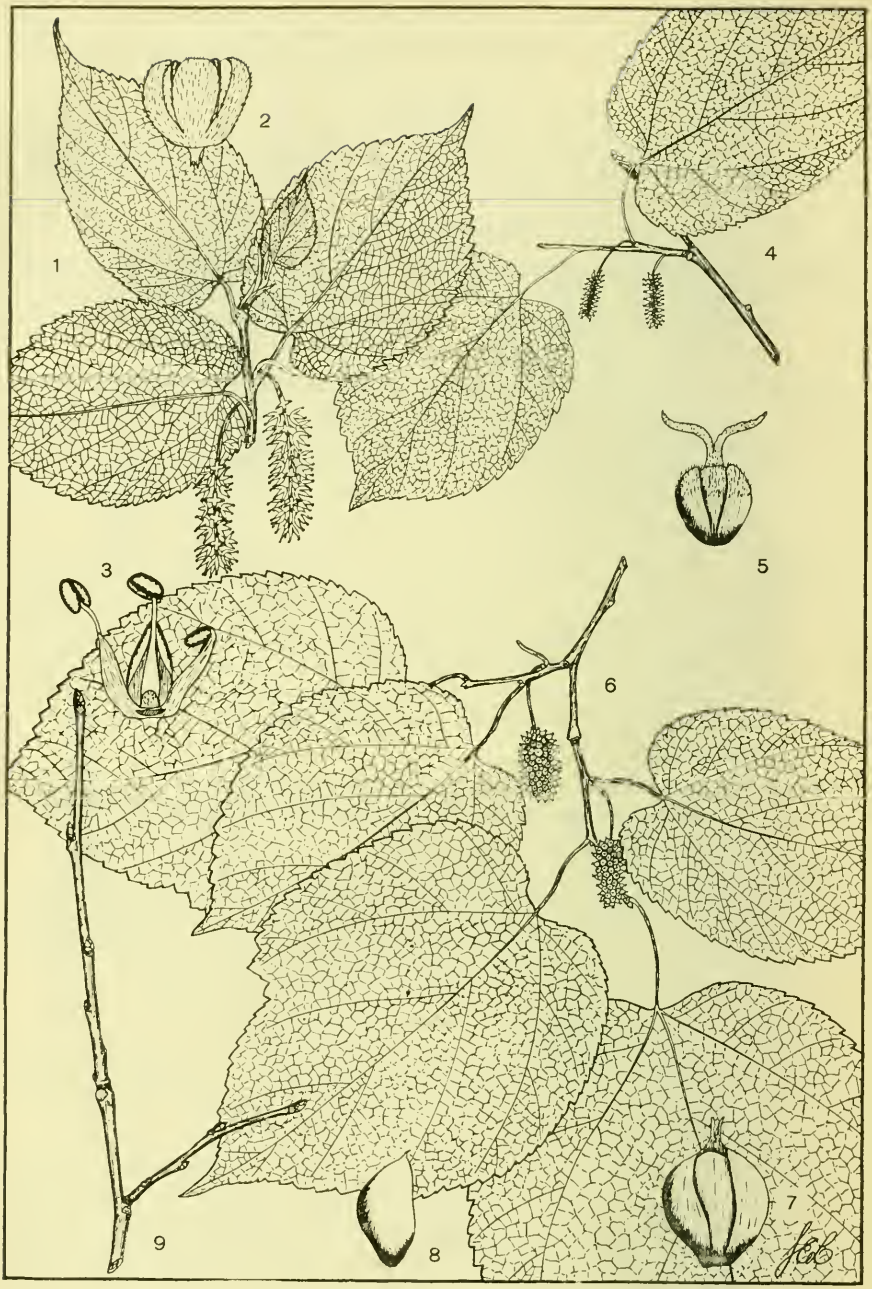
Fruit — Globular, loosely multiple, pedunculate, about ¾ of an inch in diameter, consisting of many small, fleshy, red druplets, each exserted above a persistent calyx.

Winter characters — Twigs medium stout, zigzag, greenish gray, pubescent or scabrous. Terminal bud absent. Lateral buds ovate, attenuate, divergent, greenish brown, about ⅛ of an inch long. Visible bud-scales 2–3. Mature bark nearly smooth, greenish gray marked by longitudinal, anastomosing, pale yellow lines, becoming gnarled and convoluted with age.

Habitat — Waste places along roadsides, in abandoned fields, and about the habitations of man.

Range — Introduced as an ornamental plant from eastern Asia and the neighboring islands. Now widely naturalized in the eastern states as far north as New York City. Zone A.

Uses — The fibrous inner bark is an important source of paper-making material in China and Japan. Readily propagated by seeds or cuttings and extensively grown for ornament where the climate is not too rigorous. Wood soft, light, coarse-grained, easily worked. Of no importance in the United States.



Red Mulberry

Morus rubra L.

1. A twig showing staminate inflorescences and immature leaves x ½
2. A staminate flower prior to anthesis, lateral view x 5
3. A staminate flower at anthesis, lateral view x 5
4. A twig showing pistillate inflorescences and immature leaf x ½
5. A pistillate flower, lateral view x 5
6. A twig showing mature leaves and fruit x ½
7. Fleshy calyx enclosing a nutlet, lateral view x 2
8. Nutlet, lateral view x 2
9. Winter twig x ½

MORACEAE

Morus rubra L.

Red Mulberry

Habit — A tree of medium size, usually 30–50 feet in height with a trunk diameter of 1–1½ feet, under optimum conditions in the Ohio and Mississippi valleys sometimes 70 feet tall. Trunk short, dividing near the ground into stout, ascending limbs to form a dense, broad, round-topped crown.

Leaves — Alternate, broadly ovate to ovate-orbicular, 3–5 inches long, 2½–4 inches wide, acute at the apex, cordate at the base, singly or doubly serrate on the margin or mitten-shaped or 3-lobed with deep, broad, oblique, rounded sinuses, at maturity thin, membranous, veiny, dark bluish green and nearly smooth above, pale pubescent below, borne on stout petioles ¾–1¼ inches long which exude a milky juice when broken.

Flowers — Appearing in May and early June when the leaves are about half grown, chiefly dioecious, the staminate in cylindrical, pedunculate spikes from the axils of the inner bud-scales or lower leaves, the pistillate in oblong, sometimes androgynous, pedunculate, densely-flowered spikes from the upper leaf-axils. Staminate flower with deeply 4-lobed calyx, its lobes ovate, rounded, revolute toward the apex. Stamens 4, inserted opposite the calyx-lobes, at first included but straightening elastically at anthesis and becoming exserted. Pistillate flower with 4-parted calyx. Calyx-lobes ovate to obovate, pubescent above, the outer pair valvate and inclosing the others, becoming fleshy and closely investing the ovary in fruit. Pistil consisting of an ovate, flattened, glabrous, pale green ovary surmounted by a short style and 2 spreading white stigmas.

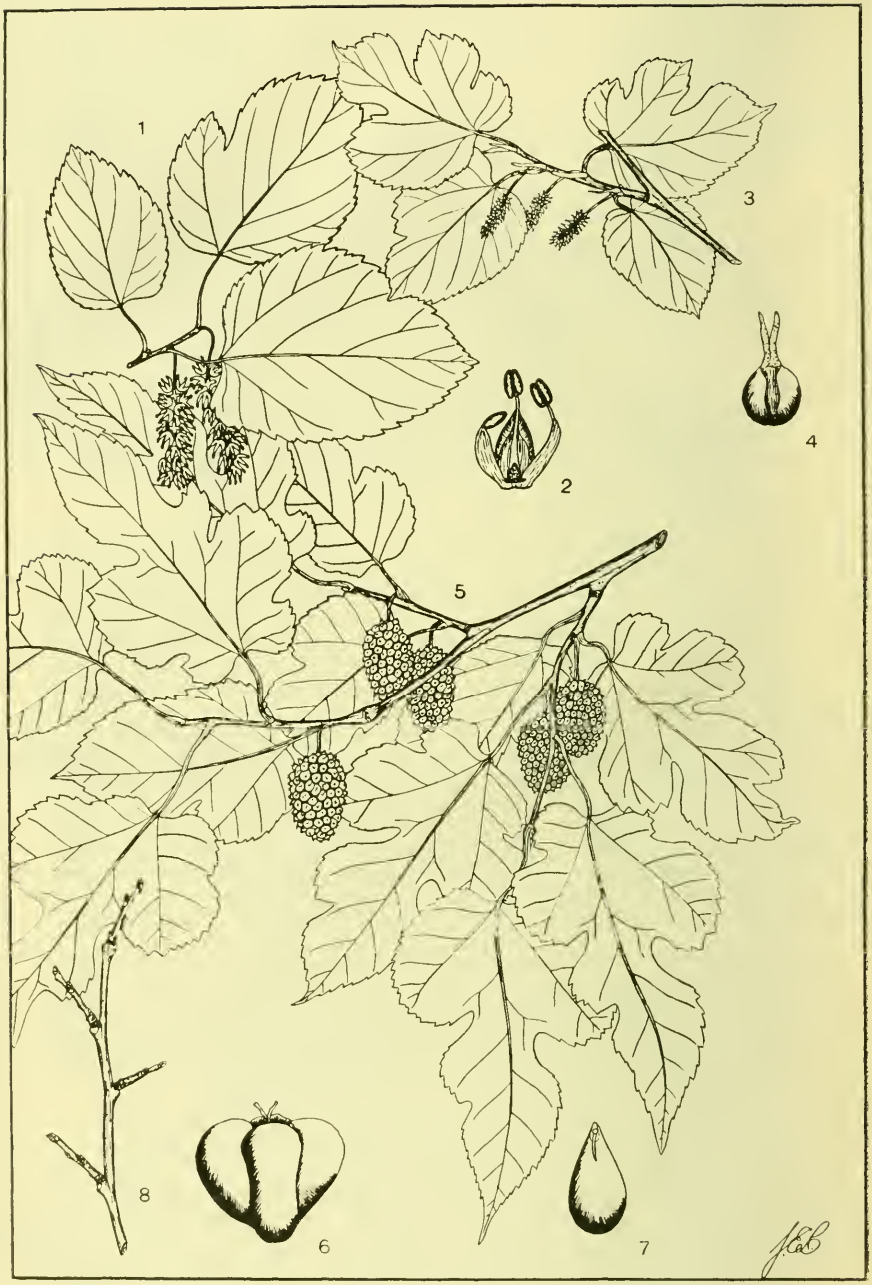
Fruit — A fleshy, multiple, pedunculate, cylindrical syncarp, 1–1¼ inches long, maturing during July in New York, composed of many small drupes each enclosed in a fleshy calyx, at first greenish red, at maturity dark purple, juicy and edible. Nutlet ovoid, sharp-pointed, light brown.

Winter characters — Twigs slender, slightly zigzag, smooth, semi-lustrous to dull, pale reddish or orange-brown, at length dark reddish brown. Terminal bud absent. Lateral buds alternate, ovate, rounded or bluntly pointed at the apex, somewhat divergent and laterally inclined, chestnut-brown, about ¼ of an inch long. Mature bark thin, dark reddish brown, with longitudinal, flaky plates.

Habitat — Prefers deep moist soils along stream courses, in rich woods, and on fertile slopes in admixture with other species.

Range — Central New England, southern Ontario, west to Nebraska and Kansas, south to Florida and eastern Texas. Zones A, B, and C.

Uses — Not an important timber species because of its mediocre size and scattered distribution in admixture with other species. Wood soft, light, weak, coarse-grained, durable in contact with the soil, pale orange turning russet-brown with exposure to the light, with thick, lighter sapwood. Used for railroad ties, fence posts, loose cooperage and furniture.



White Mulberry

Morus alba L.

1. A twig showing staminate inflorescences and immature leaves x ½
2. A staminate flower at anthesis, lateral sectional view x 5
3. A twig showing pistillate inflorescences and immature leaves x ½
4. A pistillate flower, lateral view x 5
5. A twig showing mature leaves and fruit x ½
6. Fleshy calyx enclosing a nutlet, lateral view x 3½
7. Nutlet, lateral view x 10
8. Winter twig x ½

MORACEAE

Morus alba L.

White Mulberry

Habit — A medium-sized tree 30–40 feet in height, with a trunk diameter of 1–3 feet. Bole short, stout, often irregular, fluted and swollen at the base, branching low down into stout, ascending, wide-spreading limbs to form a low, broad, rounded crown.

Leaves — Alternate, ovate to ovate-oval, 2–6 inches long, 1–3 inches wide, acute or acuminate at the apex, rounded or cordate at the base, serrate and variously lobed, at maturity thin, firm, smooth, light green and somewhat lustrous above, paler and hairy along the prominent veins beneath, borne on slender, slightly hairy petioles ¾–1¼ inches long which exude a milky juice when broken.

Flowers — Appearing in May when the leaves are about half grown, dioecious, the staminate in cylindrical, pedunculate spikes ½–¾ of an inch long from the axils of the leaves of the season, the pistillate in oblong, pedunculate, densely-flowered spikes ⅕–⅖ of an inch long, from the upper leaf-axils. Staminate flower with deeply 4-lobed calyx, its lobes ovate, rounded, revolute toward the apex. Stamens 4, inserted opposite the lobes, at first included but straightening elastically at anthesis and becoming exserted. Pistillate flower with 4-parted calyx. Calyx-lobes ovate to obovate, the outer pair valvate and inclosing the others, becoming fleshy and closely investing the ovary in fruit. Pistil consisting of an ovate, flattened, glabrous, pale green ovary surmounted by a short style and 2 white stigmas.

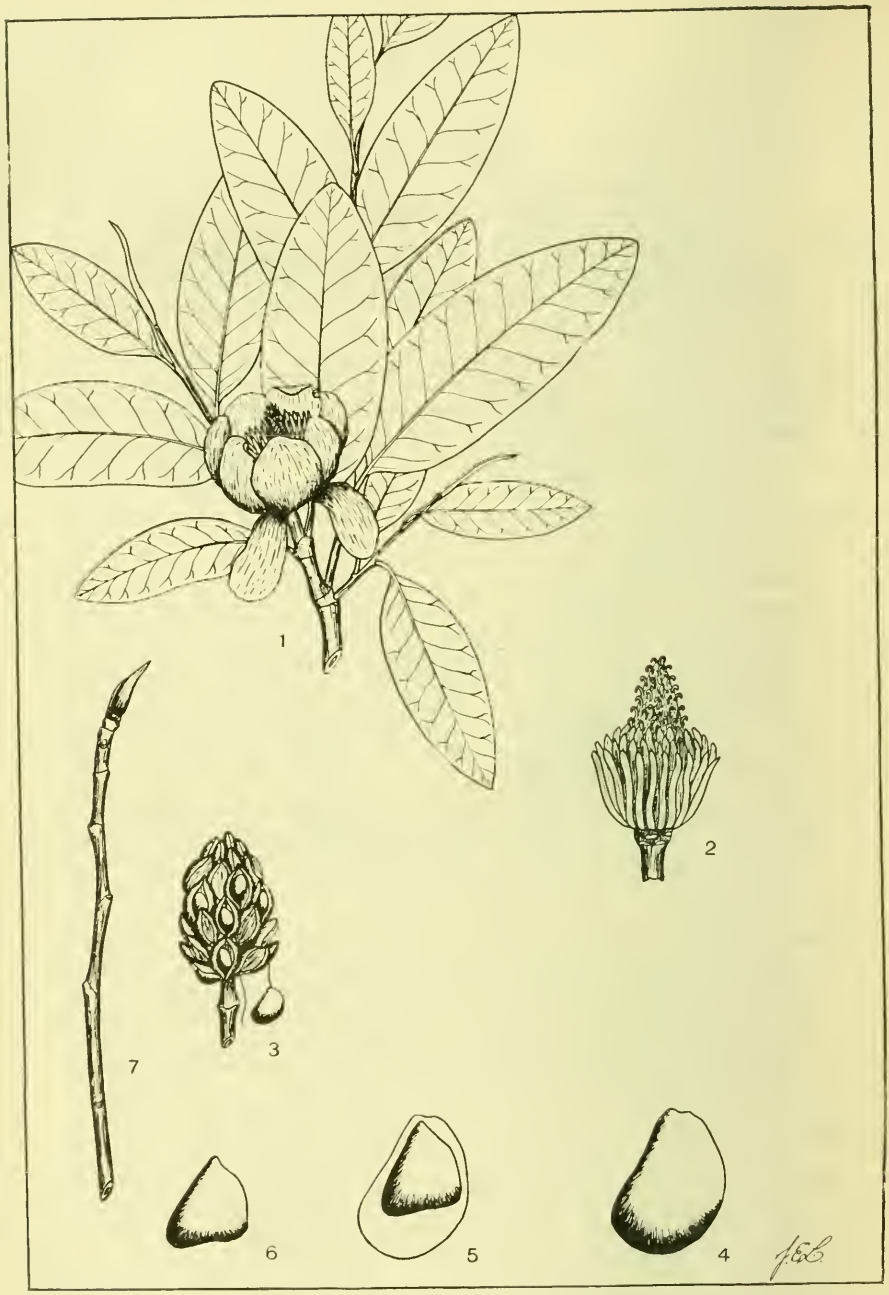
Fruit — A semi-fleshy, multiple, pedunculate, oval-oblong syncarp, ⅖–½ of an inch long, maturing in July or early August, composed of many small drupes, each inclosed in a fleshy calyx. At maturity the fruit is white or pale pinkish, and rather dry and insipid. Nutlet ovate, pointed light brown.

Winter characters — Twigs slender, somewhat zigzag, swollen at the nodes, smooth, semi-lustrous, pale yellowish green to brownish gray, at length dark brown. Lateral twigs numerous, short, giving the crown a bushy, scraggly appearance. Terminal bud absent. Lateral buds alternate, broadly ovate, somewhat appressed and laterally inclined, chestnut-brown, about ⅛ of an inch long. Mature bark thin, pale yellowish brown, broadly fissured into long, somewhat wavy, blunt ridges.

Habitat — Occurs as a "weed" tree on waste lands along fences and on rocky hillsides. Not exacting as to soil requirements.

Range — Widely naturalized through the agency of birds in eastern North America from southern Canada southward. Originally introduced into this country in an endeavor to establish the silk industry, its leaves furnishing the favorite food of the silk worm. Zones A, **B**, and C.

Uses — Of no economic significance in the United States. Widely grown in China, Japan, India and about the Mediterranean where the silk industry flourishes. Wood rather hard and heavy, close-grained, pale yellowish brown, with thick, lighter sapwood. Durable in contact with the soil.



Sweet Bay, Swamp Bay, Sweet Magnolia

Magnolia virginiana L. [Magnolia glauca L.]

1. A twig showing a flower, and mature and immature leaves x ½
2. Lateral view of the flower, perianth removed x 1
3. Cone-like fruit of coalescent follicles x ½
4. Drupaceous seed, lateral surface view x 1½
5. Drupaceous seed, lateral sectional view x 1½
6. Seed with outer fleshy integument removed x 1½
7. Winter twig x ½

MAGNOLIACEAE

Magnolia virginiana L. [Magnolia glauca L.]

Sweet Bay, Swamp Bay, Sweet Magnolia

Habit — In our range a large shrub or slender tree 20–30 feet in height with a trunk diameter of 6–9 inches, farther south under optimum conditions occasionally 50–70 feet tall. Trunk short, slender, often swollen at the base. Branches erect, at length spreading to form an oblong or rounded crown.

Leaves — Alternate, oblong to oval, 3–6 inches long, ½–1½ inches wide, obtuse or acute at both ends, entire, at maturity thick, dark green, smooth and lustrous above, minutely pubescent and pale glaucous below, borne on slender petioles ½–¾ of an inch long, falling in the north during the late autumn.

Flowers — Appearing in the north over a period of several weeks in late May or early June, terminal, creamy-white, globular perfect, fragrant, 2–3 inches across. Sepals 3, membranaceous, obtuse, spreading, deciduous. Petals 9–12, obovate, obtuse, concave, erect, deciduous. Stamens numerous, inserted in many ranks on the base of the torus, apiculate, with short filaments, deciduous after anthesis. Pistils densely imbricated on the receptacle, each consisting of a fleshy ovary and short recurved style stigmatic on its inner surface.

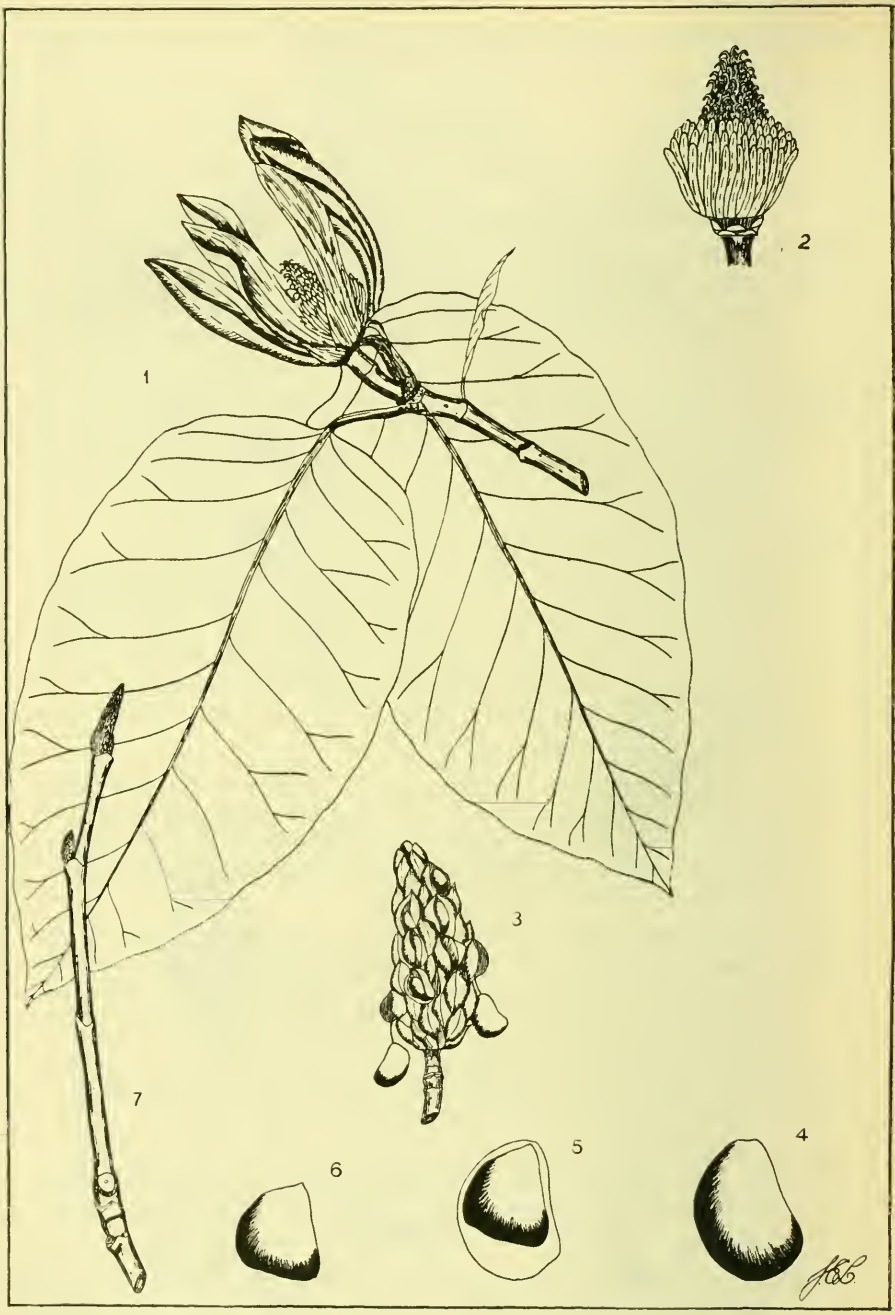
Fruit — Aggregate, cone-like, fleshy to dry, oval or irregular, about 2 inches long, consisting of many coherent scarlet follicles which open at maturity along the outer suture to release the fleshy seeds. Seed red, lustrous, drupaceous, compressed, about ¼ of an inch long, suspended at maturity by a long, thin, funicular cord.

Winter characters — Twigs rather slender, finely pubescent, bright green, at length reddish brown. Pith diaphragmed-stuffed. Buds alternate, ovate-lanceolate, acuminate, bright green, pubescent, ¼–⅗ of an inch long, covered by stipular bud-scales. Mature bark thin, light brown, smooth or covered with thin, appressed scales.

Habitat — A moisture-loving species found in swamps, on moist bottom-lands, and along the shores of lakes and streams.

Range — Eastern Massachusetts south along the coast to Florida and through the Gulf States to southwestern Arkansas and eastern Texas. Attains its largest size on the Flordia peninsula. Confined to Long Island and Staten Island in New York State. Zone A.

Uses — Not a valuable timber species. Wood soft, light, rather coarse, pale brown tinged with red, with wide pale sapwood. Used locally in the south in the manufacture of wooden ware. The importance of the species lies rather in the ornamental value of hardy varieties and hybrids.



Cucumber Tree

Magnolia acuminata L.

1. A twig showing flower and mature leaves x ½
2. Lateral view of the flower, perianth removed x 1
3. Cone-like fruit of coalescent follicles x ½
4. Drupaceous seed, lateral surface view x 1½
5. Drupaceous seed, lateral sectional view x 1½
6. Seed with outer fleshy integument removed x 1½
7. Winter twig x ½

MAGNOLIACEAE

Magnolia acuminata L.

Cucumber Tree

Habit — A large tree attaining under optimum conditions a height of 80–90 feet with a trunk diameter of 3–4 feet. In the open the bole is tapering and continuous through the pyramidal crown, the lateral limbs clothing the trunk nearly to the ground. Under forest conditions the slightly tapering trunk may be free of branches for 40–50 feet and the crown much restricted.

Leaves — Alternate, oblong to oval 4–10 inches long, 2–6 inches wide, acute at the apex, rounded or slightly cordate at the base, entire, at maturity thin, dark green, smooth and glabrous above, paler and slightly pubescent beneath, borne on slender petioles 1–1½ inches long, turning yellow in the autumn before falling.

Flowers — Appearing in the North during May and early June, terminal, glaucous-green tinged with yellow, campanulate, about 3 inches long, perfect. Sepals 3, membranaceous, acute, shorter than the petals, at length reflexed and deciduous. Petals 6, obovate, acute, concave, erect, 2½–3 inches long, deciduous. Stamens numerous, inserted in many ranks on the base of the torus, apiculate, with short filaments and pale yellow anthers, deciduous after anthesis. Pistils densely imbricated on the receptacle, each consisting of a fleshy ovary and short, recurved style stigmatic on its inner surface.

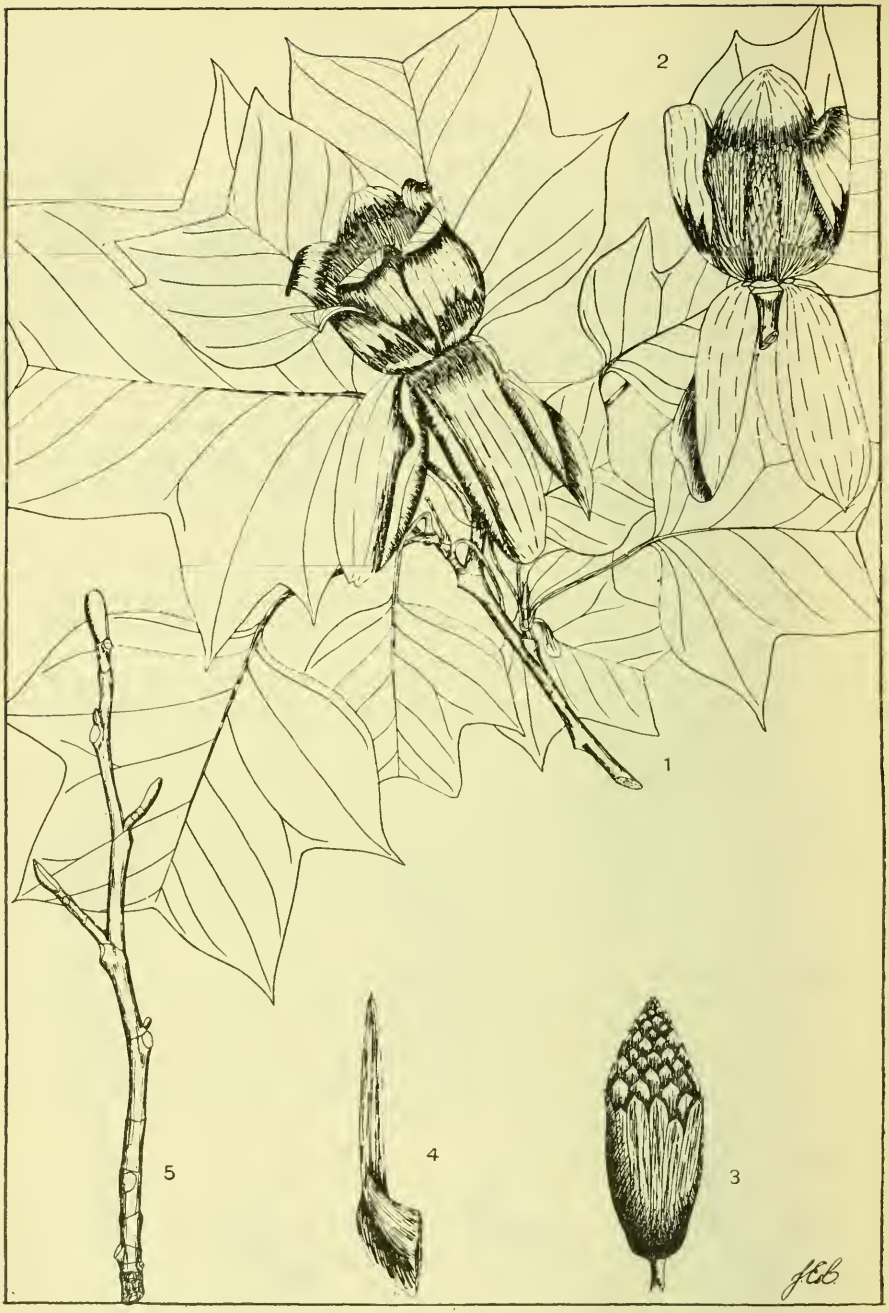
Fruit — Aggregate cone-like, somewhat fleshy, oblong or ovoid, usually curved, glabrous, 2–2½ inches long, consisting of many coherent, dark red follicles which open at maturity along the outer suture to release the fleshy seeds. Seed scarlet, drupaceous, compressed, about ⅔ of an inch long, suspended at maturity by a long, thin, funicular cord.

Winter characters — Twigs rather slender, lustrous, glabrous or sparingly pubescent, bright reddish brown, at length gray. Pith diaphragmed-stuffed. Terminal bud ovate-oblong, acute, somewhat curved, densely covered with pale silky hairs, ⅔–¾ of an inch long. Lateral buds smaller, blunt, nearly surrounded by the leaf-scar. Bud-scales stipular, valvate. Mature bark thin, dark grayish brown, separated by long furrows into scaly ridges.

Habitat — Usually found in rich woods on moist slopes and along stream courses.

Range — Central New York westward through southern Ontario to southern Illinois, southward along the Appalachian Mountains into the Gulf States and Arkansas. Zones **B** and C.

Uses — A timber species of some importance. Wood light, soft, close-grained, brittle, pale yellowish brown with thin, yellowish white sapwood. Not distinguished in the trade from that of the Yellow Poplar and used for similar purposes. The tree is also grown ornamentally in eastern United States and abroad.



Yellow Poplar, Tulip Tree

Liriodendron tulipifera L.

1. A twig showing a flower, and mature and immature leaves x ½
2. Lateral view of the flower, several petals removed x ½
3. Aggregate cone of samaroids, lateral view x ½
4. A samaroid from the cone, lateral view x 1
5. Winter twig x ½

MAGNOLIACEAE

Liriodendron tulipifera L.

Yellow Poplar, Tulip Tree

Habit — One of the largest trees of the eastern states, in the south commonly 150 feet in height with a straight trunk 5–6 feet through* and free of branches for 60–80 feet, in New York State usually 50–80 feet tall with a trunk diameter of 2–3 feet. In the open the crown is narrowly pyramidal or oblong, the branches extending to within 8–10 feet of the ground. Trees in the forest have flat, wide-spreading crowns borne aloft on tall, straight, naked trunks.

Leaves — Alternate, broadly ovate to orbicular, 5–6 inches long and broad, truncate or broadly notched at the apex, rounded or slightly cuneate at the base, sinuately 4-lobed, at maturity dark green, smooth and lustrous above, dull green and paler below, borne on slender angled petioles 5–6 inches long.

Flowers — Appearing during May and June after the leaves, terminal, solitary, greenish yellow with orange markings, cup-shaped, 2–3 inches wide, 1–1½ inches deep, perfect. Sepals 3, ovate-lanceolate, greenish white, at length reflexed and early deciduous. Petals 6, broadly ovate, rounded, erect, light green marked with orange at the base, deciduous. Stamens numerous, inserted in many ranks on the base of the torus, with filiform filaments and linear yellow anthers, deciduous after anthesis. Pistils densely imbricated on the elongated receptacle, each consisting of a 1-celled ovary surmounted by an acuminate and laterally compressed style and short recurved stigma.

Fruit — A light brown cone, 2–3 inches long, composed of many closely imbricated, indehiscent carpels (samaroids). Carpels dry, woody, consisting of a laterally compressed, 4-ribbed pericarp and large, persistent, winged style, falling during the autumn and winter from the persistent, upright cone-axis. Seed solitary by abortion.

Winter characters — Twigs rather stout, smooth, lustrous, somewhat glaucous, reddish brown, at length dark gray. Pith diaphragmed-stuffed. Terminal bud oblong, compressed, obtuse, dark red, glaucous and white-punctate, ½–1 inch long, the scales stipular and valvate in pairs. Lateral buds similar, divergent, sometimes superposed or terminal on short spurs, ⅛–½ of an inch long. Mature bark thick, brown, with long shallow furrows and rounded ridges.

Habitat — Prefers deep moist soil in admixture with other species. Occurs along streams, on bottom-lands, and on moist mountain slopes.

Range — Rhode Island and southwestern Vermont westward through Ontario to Wisconsin, south to Florida and Arkansas. Zones A, B and C.

Uses — A valuable timber species producing the Yellow Poplar or Whitewood of commerce. Wood light, soft, brittle, weak, straight-grained, pale greenish yellow or brown with thin, nearly white sapwood. Largely manufactured into lumber and used where a soft, easily-worked wood is required. The tree is widely cultivated in the east and abroad for its ornamental value.

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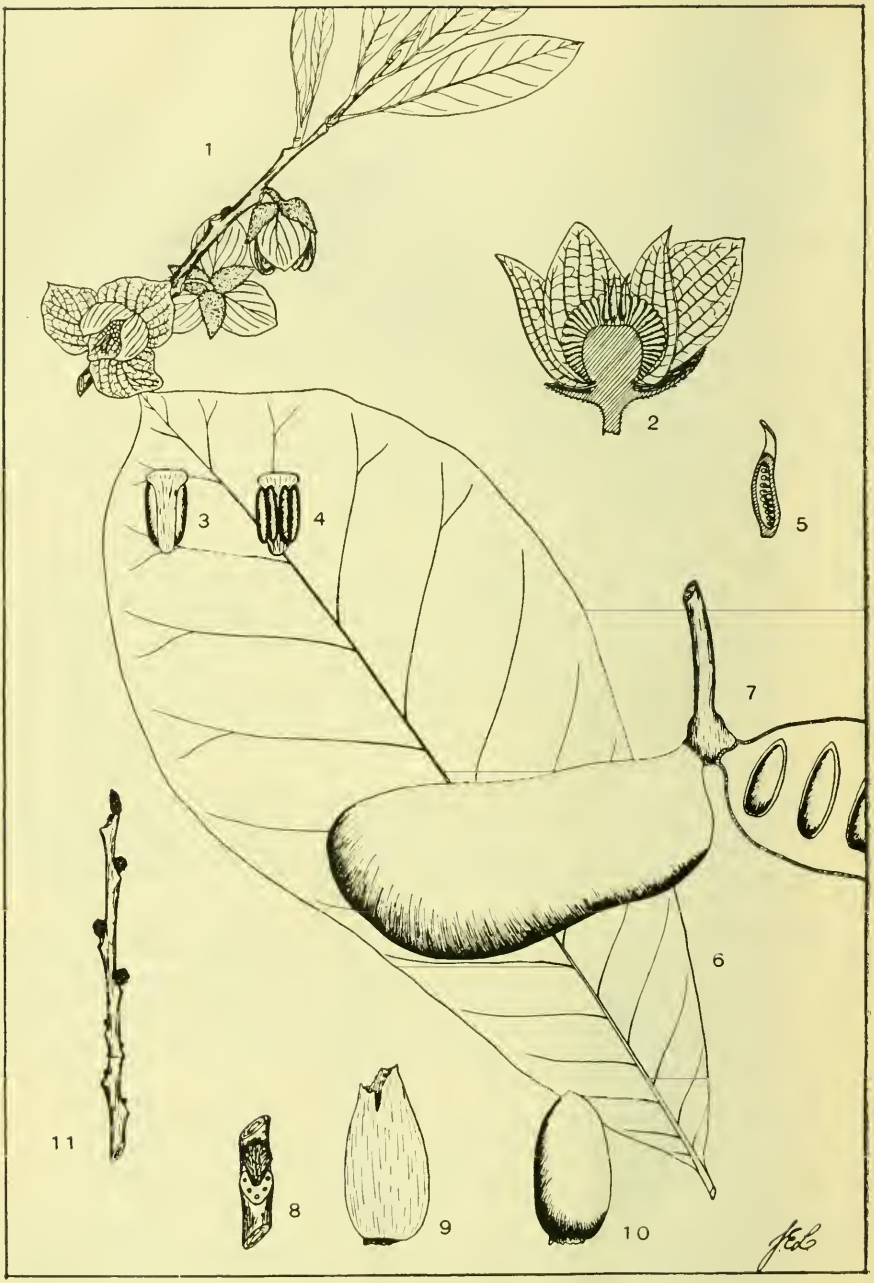
* Trees are known which have reached a height of 200 feet with a trunk diameter of 8–10 feet.



Papaw

Asimina triloba Dunal. [Anona triloba L.]

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 2
3. A stamen, dorsal view x 5
4. A stamen, ventral view x 5
5. A pistil, lateral sectional view x 3
6. A mature leaf x ½
7. Fruit, surface and sectional views x ½
8. Portion of twig showing lateral bud and leaf-scar x 1
9. Mature seed enclosed in its aril x 1
10. Mature seed x 1
11. Winter twig x ½

ANONACEAE

Asimina triloba Dunal. [Anona triloba L.]

Papaw

Habit — A shrub or small tree 20–40 feet in height with a maximum trunk diameter of 12 inches. Bole short and slender. Branches slender, spreading, forming a rather broad, high crown. This species often forms dense thickets in the shade of other trees.

Leaves — Alternate, obovate-lanceolate, 4–12 inches long, 2–6 inches wide, sharply acute at the apex, tapering gradually at the base, entire, at maturity dull green and glabrous above, paler and glabrous below, borne on a short, stout petiole ½–¾ of an inch long.

Flowers — Appearing in our range in late May and June, with the leaves but usually below them on the twigs, axillary, solitary, perfect, at maturity reddish purple, 1½–2 inches in diameter, borne on short, stout, hairy, brown pedicels. Sepals 3, ovate, pale green, densely pubescent on the outer surface. Petals 6, purple, reticulate-venulose, the 3 outer broadly ovate and reflexed above the middle and much longer than the sepals, the 3 inner smaller, erect, nectariferous at the base. Stamens numerous, densely packed on the receptacle. Pistils sessile on the summit of the receptacle, projecting above the stamens, each consisting of a 1-celled ovary and sessile stigma.

Fruit — An oblong-cylindric or oval, somewhat falcate, smooth, green berry, becoming dark brown, pulpy and edible at maturity. Seeds dark brown, lustrous, ovate-oblong and compressed, about 1 inch long and half as wide, enclosed in an aril, horizontally imbedded in the fleshy pulp.

Winter characters — Twigs rather slender, quite glabrous, thickened at the nodes, reddish brown and marked with narrow, shallow grooves. Buds alternate, naked, rusty brown, tomentose. Leaf-buds slender, somewhat flattened, the lateral buds closely appressed to the twig and set in the notch of the leaf-scar. Flower-buds lateral, spherical in outline, divergent. Pith small, white. Mature bark thin, close, dark brown, slightly scaly at the surface.

Habitat — Prefers moist sites along streams in rich bottom-land forests and on low, fertile slopes. Very tolerant of shade. At its optimum range often forming the bulk of the undergrowth under other species but in New York State usually in small isolated groups.

Range — Western New York westward through southern Michigan to eastern Kansas, south to Florida and eastern Texas. Zone B.

Uses — Of no timber value because of its small size and the character of the wood. The edible fruit is sold in the regions where the tree abounds but is not grown commercially. The species possesses some ornamental value.

Sassafras

Sassafras variifolium (Salisb.) Ktze. [Sassafras Sassafras Karst.; Sassafras officinale Nees. and Eberm.]

1. A twig showing immature leaves and staminate flowers x 1
2. A staminate flower, lateral sectional view x 3
3. A twig showing immature leaves and pistillate flowers x 1
4. A pistillate flower, lateral sectional view x 3
5. A branch showing mature leaves and fruit x ½
6. Drupe, lateral sectional view x 2
7. Pit, lateral view x 2
8. Winter twig x ½

LAURACEAE

Sassafras variifolium (Salisb.) Ktze. [Sassafras Sassafras Karst.; Sassafras officinale Nees. and Eberm.]

Sassafras

Habit — A medium-sized tree, commonly 40–50 feet in height with a trunk diameter of 1–3 feet, generally shrubby at the northern limits of its range, in the south occasionally 100 feet tall. Trunk short, stout, soon breaking up into many stout, more or less abruptly spreading and contorted branches to form a flat-topped or rounded-oblong, bushy crown.

Leaves — Alternate, ovate or obovate, 4–6 inches long, 2–4 inches wide, entire and acute at the apex or 2–3-lobed, the lobes broadly ovate and acute with broad, rounded sinuses. At maturity the leaves are thin, dull dark green above, paler and glabrous or pubescent below, borne on slender petioles, ¾–1½ inches long.

Flowers — Appearing in May with the leaves, dioecious, borne in lax, pilose, few-flowered racemes from the axils of large, obovate bud-scales. Calyx pale yellowish green, divided nearly to the base into 6 narrow obovate lobes. Stamens 9, inserted in 3 sets on the margin of the calyx-tube, those of the inner set with orange-colored glands at the base and reduced in the staminate flowers to orange-colored staminodia. Anthers opening by 4 pores. Pistil consisting of a 1-celled, light green, glabrous ovary, a slender curved style and a capitate stigma.

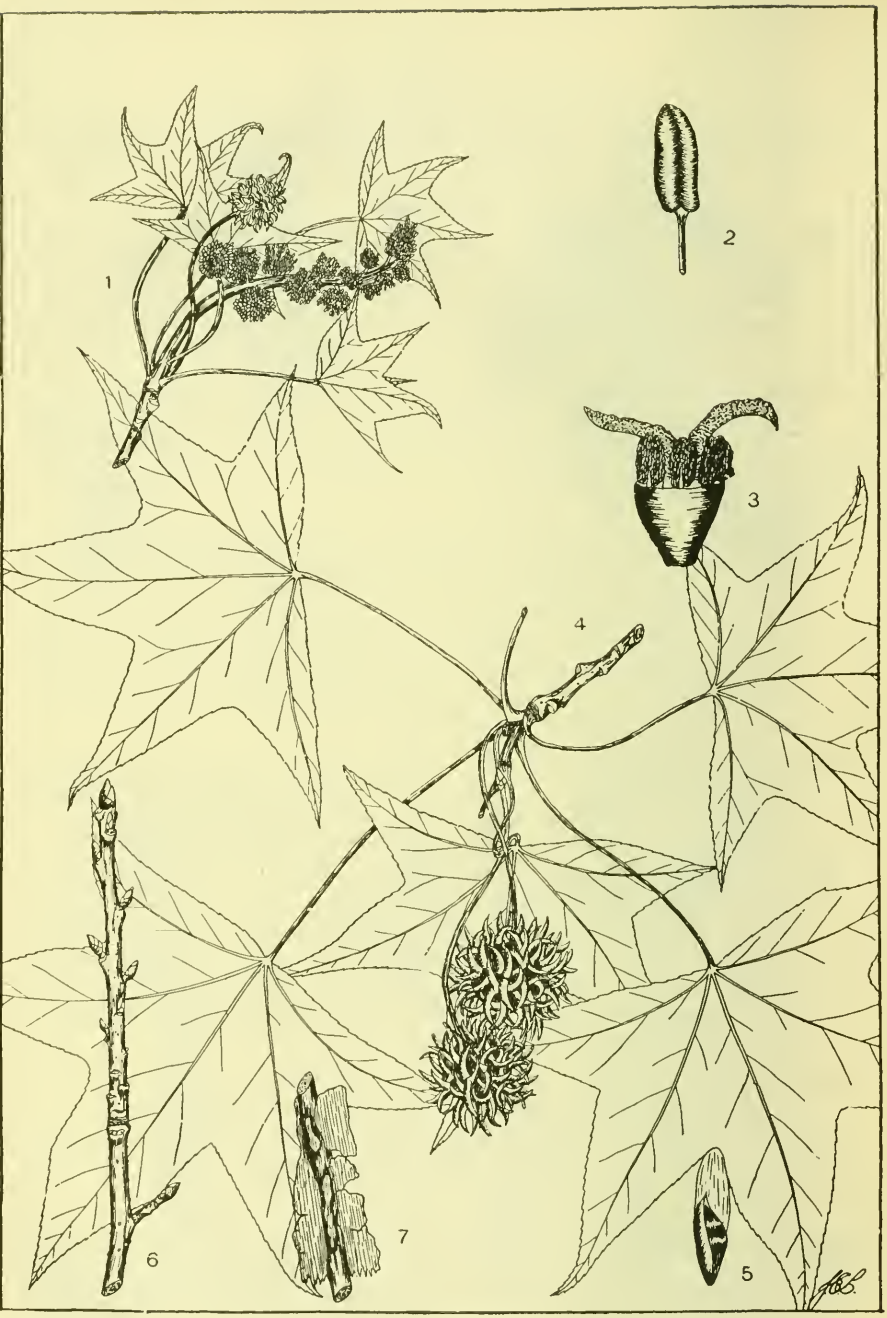
Fruit — An oblong, 1-seeded, dark blue, lustrous berry, ⅖–⅗ of an inch long, borne upright on a bright red, club-shaped, fleshy stem which is terminated by the fleshy, obscurely 6-lobed calyx-limb in which the fruit rests, falling soon after maturity from the persisting stalk.

Winter characters — Twigs slender, smooth and lustrous or somewhat downy, rather brittle, spicy-aromatic, light yellowish green, at length reddish brown. Vigorous shoots branch freely the first season. Inner bark mucilaginous. Pith large, white. Terminal bud ovate, acute, green, ⅓–⅗ of an inch long. Lateral buds smaller and divergent. Mature bark thick, reddish brown, with deep furrows and flat-topped ridges crossed by horizontal cracks.

Habitat — Prefers a rich, sandy loam but thrives in a variety of sites along fences, in abandoned pastures, and in open, hardwood forests.

Range — Central New England west through southern Ontario, southern Michigan to Iowa and eastern Kansas, south to Florida and eastern Texas. Zones A, B and C.

Uses — Not an important timber species. Wood soft, brittle, coarse-grained, aromatic, dull orange-brown with pale yellow sapwood, very durable in contact with the soil. Used for fence posts, pails, in cooperage, etc. The oil of sassafras which is used to scent soap and liniment, is distilled from the roots and bark of this species.



Sweet Gum, Bilsted, Red Gum

Liquidambar Styraciflua L.

1. A twig showing staminate and pistillate inflorescences, and immature leaves x ½
2. A stamen, lateral view x 6
3. A pistillate flower, lateral view x 6
4. A branch showing mature leaves and fruit x ½
5. Winged seed, lateral view x 2
6. Winter twig x ½
7. Portion of twig with corky wings x 1

HAMAMELIDACEAE

Liquidambar Styraciflua L.

Sweet Gum, Bilsted, Red Gum

Habit — An important timber species, usually 40–80 feet in height with a trunk diameter of 2–3 feet, under optimum conditions sometimes 150 feet tall with a trunk 4–5 feet through. Bole tapering, continuous into the crown. Crown at first pyramidal and symmetrical, becoming narrowly oblong in older trees.

Leaves — Alternate, nearly orbicular, 3–6 inches in diameter, truncate or cordate at the base, deeply 5–7-lobed and palmately veined, the lobes acuminate, widely divergent (stellate), finely glandular, serrate. At maturity the leaves are thin, smooth, lustrous and bright green above, green and smooth below except for tufts of rufous hairs in the vein axils, borne on slender petioles 5–7 inches long.

Flowers — Appearing in our range during May on the growth of the season when the leaves are about one-third grown, monoecious, borne in capitate heads, subtended by 4 deciduous bracts. Staminate heads about ¼ of an inch in diameter, borne in terminal racemes. Staminate flowers without calyx or corolla. Stamens indefinite, interspersed among minute scales. Pistillate heads about half an inch in diameter, borne solitary on long peduncles from the axils of the upper leaves. Pistillate flowers interspersed among long-armed scales. Calyx obconic. Stamens 4, inserted on the summit of the calyx, usually sterile. Pistil consisting of an inferior ovary surmounted by 2 elongated, recurved, persisting, subulate styles stigmatic on the inner surface. Ovules numerous.

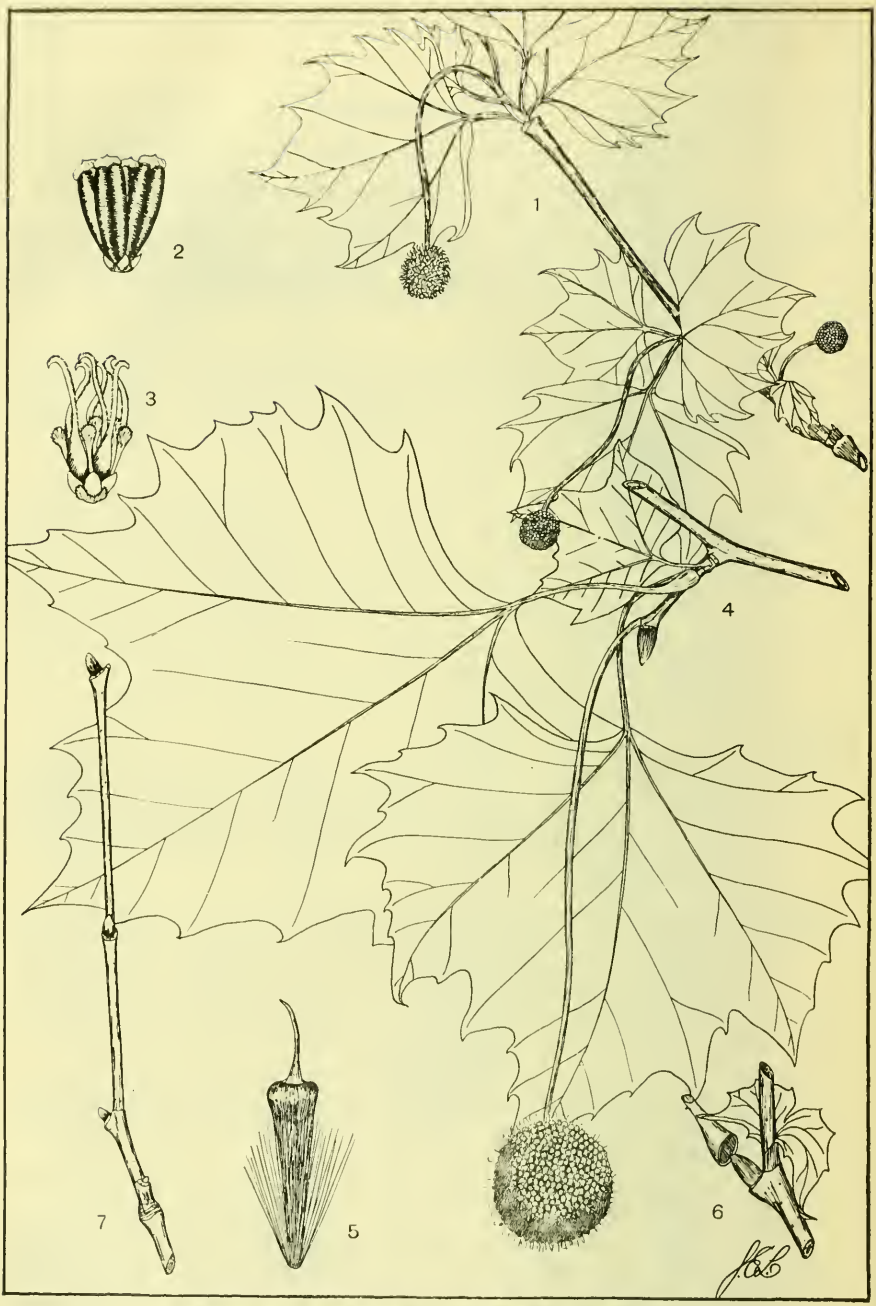
Fruit — A long-stalked, globose, light brown, aggregate head, 1–1½ inches in diameter, consisting of many imbedded, woody capsules, each capped by the 2 horn-like, wide-spreading, woody styles. The fruits mature in autumn but persist far into the winter. Fertile seeds angular, winged, light brown, seldom more than one to a capsule. Sterile seeds numerous, resembling sawdust, rattling out of the capsules along with the fertile seeds at maturity.

Winter characters — Twigs rather stout, glabrous, somewhat angled and lustrous, roughened by dark, raised lenticels, light orange to reddish brown, becoming darker the second season and often developing characteristic corky wings. Pith pale brown, rather large and angular. Buds ovate to conical, obtuse or acute, lustrous orange-brown, ¼–½ of an inch in length, fragrant when crushed. Mature bark thick, dark reddish brown, with deep furrows and broad, flat-topped, scaly ridges.

Habitat — A bottom-land species preferring the deep, rich, moist soils of river flats and the borders of swamps and lakes where the ground is inundated for a period each year. An intolerant species usually forming open, even-aged groves, or in admixture with other species.

Range — Southern Connecticut westward through Pennsylvania to southern Missouri, south to Florida and eastern Texas. Zone **A**.

Uses — A "weed" tree occupying sites suited for other more valuable species or for agriculture, but producing a fair grade of lumber. Wood medium soft, rather heavy, straight- and close-grained, weak, dark reddish brown and streaked, with thin, nearly white sapwood. Widely used for loose cooperage, veneer, boxes, crates, woodenware and for interior finish as a substitute for Circassian Walnut under the trade name of Satin Walnut. The tree is also grown ornamentally.



Sycamore, Buttonwood, Plane Tree

Platanus occidentalis L.

1. A twig showing staminate and pistillate inflorescences, and immature leaves x ½
2. A staminate flower, lateral view x 5
3. A pistillate flower, lateral view x 5
4. A branch showing mature leaves and fruit x ½
5. An achene with pappus-wing x 3
6. A twig-node showing persistent stipules, bud, and hollow leaf-stalk x 1
7. Winter twig x ½

PLATANACEAE

Platanus occidentalis L.

Sycamore, Buttonwood, Plane Tree

Habit — The most massive tree of eastern North America, commonly 50–100 feet in height with a trunk diameter of 3–8 feet, under optimum conditions sometimes 150–170 feet tall with a trunk diameter of 11 feet. Bole erect or often declined, tapering, continuous through the oblong head or soon breaking up near the ground into several large, massive limbs to form a broad, rounded, irregular crown.

Leaves — Alternate, broadly ovate or orbicular, 4–7 inches in diameter, truncate, slightly cordate or cuneate at the base, shallowly 3–5 lobed and palmately veined, the lobes broad, acuminate, sinuately dentate with remote acuminate teeth, or entire. At maturity the leaves are thin, firm, smooth and bright green above, paler and white-woolly below on the principal veins, borne on stout petioles 1–2½ inches long.

Flowers — Appearing on the growth of the season during May when the leaves are about one-fourth grown, monoecious, borne in capitate heads. Staminate heads dark red, about ¼ of an inch in diameter, borne axillary on long, stout, woolly peduncles. Perianth of 3–5 minute sepals and petals. Stamens 3–6, nearly sessile, with yellow, clavate anthers. Pistillate heads pale green tinged with red, about ½ of an inch in diameter, borne terminally on long, stout, woolly peduncles. Perianth of 3–6 sepals and petals. Pistils as many as the sepals, superior, surrounded by a like number of spatulate staminodia, each consisting of an ovate-oblong ovary surrounded at the base by long pale hairs which persist in fruit, and long, tapering, bright red styles stigmatic along the ventral suture.

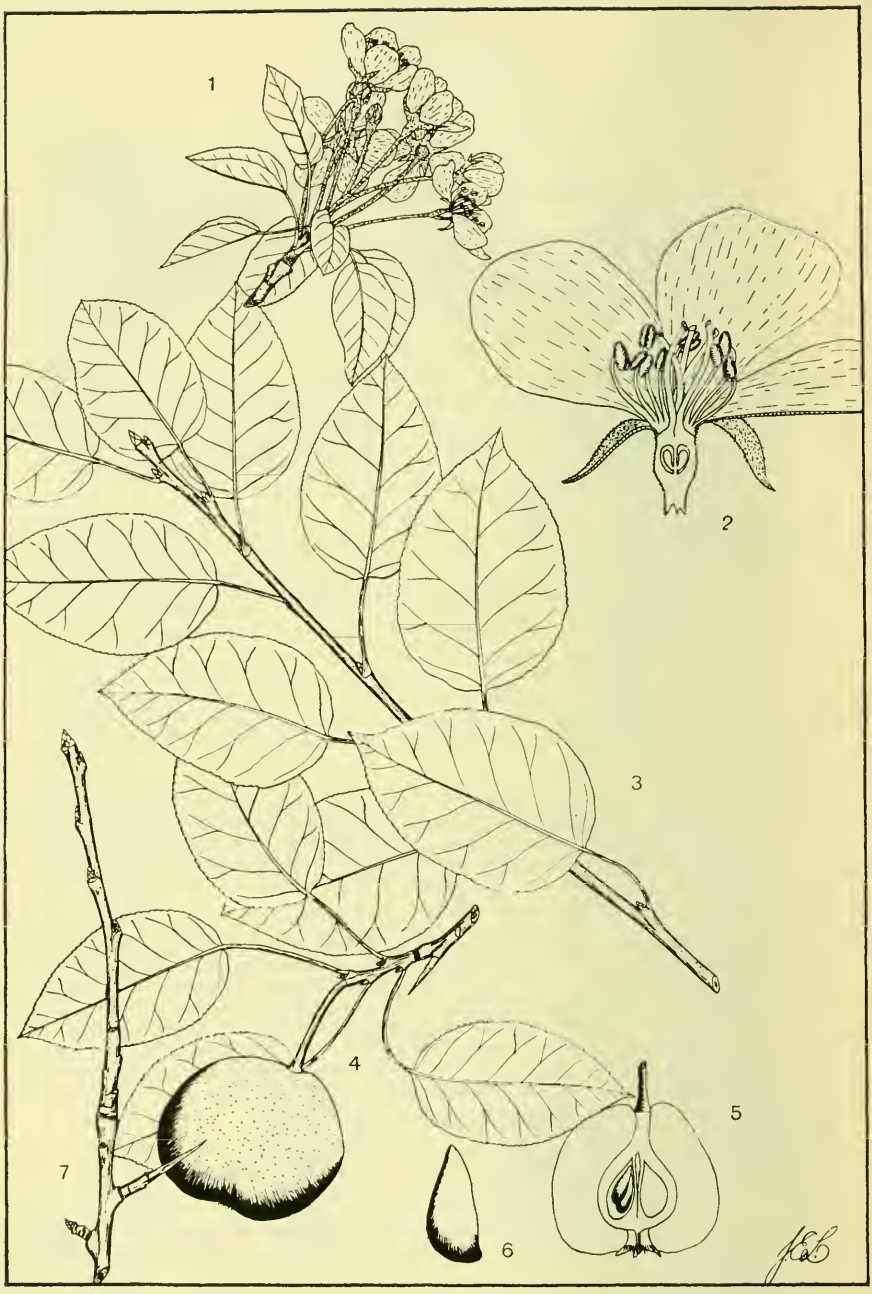
Fruit — A spherical, brown, aggregate head, about 1 inch in diameter, borne on a long, smooth peduncle 2½–6 inches long, consisting of many closely-compacted, clavate, 1-seeded nutlets, each crowned by the remains of the persistent style and furnished with a ring of bristly hairs about the base. The heads mature in the late autumn but persist on the branches into the winter and following spring.

Winter characters — Twigs rather stout, smooth, somewhat lustrous, zigzag, enlarged at the nodes and encircled by stipule-scars, dark orange-brown, at length light gray. Pith white and rather broad. Terminal bud absent. Lateral buds divergent, conical, obtuse, lustrous, reddish brown, ⅛–⅜ of an inch long, subpetiolar until leaf-fall. Mature bark at base of trunk thick, dark brown, deeply furrowed with broad ridges which peel off as dark brown scales. On young trunks or large limbs the bark is much thinner and flakes off during the early summer in large plates, exposing a whitish, yellowish, or greenish inner bark.

Habitat — Thrives best along river banks and on rich, moist bottom-lands but will grow in rather dry soils. Attains its best development in the Ohio and Mississippi River basins.

Range — Southern Maine westward through southern Ontario and Michigan to Minnesota and Nebraska, south to Florida and eastern Texas. Zones A, B and C.

Uses — A timber species of secondary importance. Wood hard, heavy, weak, coarse-grained not durable, light brown with pale yellowish sapwood. Used for crates, tobacco boxes, butchers' blocks and for interior finish as quartered sycamore. Occasionally planted ornamentally.



Pear

Pyrus communis L.

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 2
3. A branch with mature leaves x ½
4. A branch with mature leaves and fruit x ½
5. Fruit, lateral sectional view x ½
6. Seed, lateral view x 2
7. Winter twig x ½

ROSACEAE

Pyrus communis L.

Pear

Habit — A slow-growing, long-lived tree attaining under optimum conditions a height of 75 feet with a trunk diameter of 2 feet, usually much smaller in cultivation. Bole straight, continuous into the crown, bearing short, stout, ascending branches which form an oblong or pyramidal crown.

Leaves — Alternate, ovate-oblong to oval or obovate, 2–4 inches long, ¾–1½ inches wide, acute or acuminate at the apex, obtuse or rounded at the base, finely serrate or entire, at maturity thick, smooth, dark green and lustrous above, paler and smooth below, borne on slender petioles 1½–4 inches long.

Flowers — Appearing in April and May with the leaves, perfect, ¾–1 inch in diameter, borne on slender, usually downy pedicels in few- or many-flowered, umbel-like cymes on short spur-like branches of the previous season. Calyx gamosepalous, urn-shaped, pubescent, 5-lobed, the lobes acuminate, as long as the tube and ciliate on the margin. Petals white, broadly obovate, rounded at the apex, contracted at the base, inserted with the stamens on the calyx-tube. Stamens about 20, shorter than the petals. Pistil consisting of an inferior 5-celled ovary and 5 styles which are connate at the base and bear capitate stigmas.

Fruit — A pyriform or subglobose, waxy-green pome, about 2 inches long in the wild form, marked at the top by the persistent calyx-lobes and stamen-filaments, borne on a slender stalk about 1 inch long, ripening and turning yellowish green in the autumn. Flesh in the wild form rather dry, sour, permeated with grit cells. Carpels coriaceous, enclosing 2 lustrous brown seeds.

Winter characters — Twigs stout, nearly smooth and somewhat lustrous, brownish red with scattered, pale yellow lenticels. Short spinescent twigs commonly present. In addition fruiting-trees have stout, slow-growing fruit spurs marked by numerous leaf-scars. Terminal buds conical, sharply acute, smooth or slightly pubescent at the tip, chestnut-brown, about ⅓ of an inch long. Mature bark thin, grayish brown, at first smooth, at length dissected by shallow fissures into broad, flat, scaly ridges.

Habitat — Thickets, open woods, fence rows, old pastures and waste lands, occurring as an escape. Seeds often disseminated by cattle which eat the acidulous fruit.

Range — Native to Eurasia but now widely cultivated in its various varieties for its fruit throughout the temperate regions of the world. Widely naturalized in the northeastern states as an escape. Zones A, B, and C.

Uses — Not a timber species. Wood hard, heavy, strong, close-grained, reddish brown with paler sapwood. Used occasionally for tool handles, knife handles, wood engraving, and for fuel. The value of the species lies in its horticultural and ornamental varieties.

Sweet Crab, Fragrant Crab, American Crab Apple

Pyrus coronaria L. [Malus coronaria (L.) Mill.]

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 2
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 1
5. Seed, lateral view x 2
6. Winter twig x ½

ROSACEAE

Pyrus coronaria L. [*Malus coronaria* (L.) Mill.]

Sweet Crab, Fragrant Crab, American Crab Apple

Habit — A bushy shrub or small tree 20–30 feet in height with a trunk 6–14 inches in diameter. Trunk short, dividing 8–10 feet above the ground into several stout, wide-spreading limbs to form a broad, round-topped, bushy crown.

Leaves — Alternate, ovate or nearly triangular, 3–4 inches long, 1½–2½ inches broad, sharply acute at the apex, rounded or acute at the base, the margin incised-serrate with gland-tipped teeth or 3-lobed, at maturity thin, smooth, dark green above, pale green and glabrous or slightly pilose below, borne on slender petioles 1½–2 inches long.

Flowers — Perfect, fragrant, 1½–2 inches in diameter, long-pedicellate, appearing during May and early June when the leaves are nearly grown in 5–6-flowered, terminal umbels. Calyx urn-shaped, white-tomentose, 5-lobed, the lobes long, acute, subulate-tipped, spreading, hairy on the upper side, persistent in the fruit. Petals rosy-white, obovate, rounded at the apex, clawed at the base, entire or crenulate-serrate, inserted with the stamens on the calyx-tube. Stamens usually 20, shorter than the petals, the filaments united into a tube at the base. Pistil consisting of an inferior 5-celled ovary, 5 filiform styles which are hairy and somewhat united below, and a like number of capitate stigmas.

Fruit — A depressed-globose, glaucous-green pome, 1½–2 inches in diameter, borne on a long, slender stalk, ripening in late autumn and becoming yellowish green and fragrant. Flesh very tart. Seeds chestnut-brown, lustrous.

Winter characters — Twigs rather stout, pale-lenticellate, glabrous or slightly pubescent, reddish brown. In the second year they become light brown and develop short, stout spurs or sharp spines. Buds ovate, obtuse or acute on the more vigorous shoots, bright red, ⅛–¼ of an inch long. Mature bark thin, reddish brown, divided by shallow fissures into broad, flat-topped, scaly ridges.

Habitat — In rich moist soil, in copses, open woods and along fences, occasionally forming thickets of limited extent.

Range — Central New York westward through Ontario and Michigan to southern Minnesota, south into the Gulf States.

Uses — Not a timber species. The acid fruit is sometimes made into preserves. The species has ornamental value because of its showy, fragrant flowers.

Apple

Pyrus Malus L. [Malus Malus (L.) Britt.]

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 2
3. A branch with mature leaves and fruit x ½
4. Fruit, lateral sectional view x ¾
5. Seed, lateral view x 3
6. Winter twig x ½

ROSACEAE

Pyrus Malus L. [Malus Malus (L.) Britt.]

Apple

Habit — A small tree 30–50 feet in height with a short trunk 1–3 feet in diameter which breaks up a few feet above the ground into stout, wide-spreading limbs to form a broad, rounded head.

Leaves — Alternate, ovate to oval, ¾–3 inches long, blunt or abruptly pointed at the apex, rounded or somewhat heart-shaped at the base, irregularly serrate or entire, at maturity thick, dark dull green and quite glabrous above, close white-woolly beneath, borne on stout, hairy petioles, ¾–2 inches long.

Flowers — Appearing during May and June when the leaves are about one-third grown, perfect, 1–2 inches in diameter, borne on stout woolly pedicels in terminal, few-flowered cymes. Calyx gamosepalous, urn-shaped, woolly, 5-lobed, the lobes narrowly triangular and acute, reflexed, persistent in the fruit. Petals white or pinkish white, obovate, rounded at the apex, clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 20, shorter than the petals, the stout filaments bearing yellowish or purple anthers. Pistil consisting of an inferior 5-celled ovary and 5 filiform, hairy styles, each terminated by a capitate stigma.

Fruit — A depressed-globose, waxy-green pome, 1–3 inches in diameter, marked at the top by the persistent calyx-lobes, borne on a slender stalk 1–1½ inches long, ripening and turning yellowish green or reddish in the autumn. Flesh coarse and sour. Seeds chestnut-brown, lustrous.

Winter characters — Twigs rather stout, sparingly pubescent or smooth, reddish or purplish brown, at length dark grayish brown and smooth. Fruit-spurs short, stout, roughened by numerous leaf-scars. Buds ovate, obtuse, tomentose, grayish white, ⅛–⅓ of an inch long. Mature bark thin, grayish brown, sloughing off in small, thin, irregular scales.

Habitat — A "weed" tree growing as an escape on a wide variety of sites in pastures, thickets, and along fences and roadsides. Seeds often disseminated by cattle which eat the sour fruit.

Range — Supposed to have come originally from southeastern Europe and western Asia but cultivated since early times in the Old and New World. Widely naturalized in the eastern United States as an escape. Zones A, B, C, and D.

Uses — Not a timber species. Wood hard, strong, close-grained, reddish brown with thin, pale sapwood. Used for firewood and occasionally for tool handles. The importance of the species lies in its horticultural value as the stock from which the various varieties of cultivated apples have been derived. Dwarf- and double-flowered forms are grown ornamentally.

American Mountain Ash

Pyrus americana (Marsh.) DC. [Sorbus americana Marsh.]

1. A branch showing inflorescence and mature leaves x ½
2. A flower, lateral sectional view x 5
3. A fruit cluster, lateral view x ½
4. Fruit, lateral sectional view x 3
5. Seed, lateral view x 5
6. Winter twig x ½

ROSACEAE

Pyrus americana (Marsh.) DC. [*Sorbus americana* Marsh.]

American Mountain Ash

Habit — A small tree 20–30 feet in height with a trunk diameter of 4–12 inches, often a shrub propagating by means of root-suckers. Trunk short, breaking up a few feet above the ground into spreading, slender branches to form a narrow, round-topped head.

Leaves — Alternate, odd-pinnately compound, 6–8 inches long, consisting of 13–17 sessile or nearly sessile leaflets arranged in pairs along a slender petiole, the terminal leaflet stalked. Leaflets lanceolate, acuminate at the apex, rounded or cuneate and inequilateral at the base, serrate, 2–3 inches long, ½–⅔ of an inch broad, at maturity thin, glabrous and dark yellowish green above, paler below.

Flowers — Appearing during May and June after the leaves are fully grown, perfect, about ⅛ of an inch in diameter, borne on short, stout pedicels in flat, compound cymes 2–3 inches in diameter. Calyx gamosepalous, obconic, puberulous, 5-lobed, the lobes short, triangular and tipped with minute glands. Petals white, orbicular, short-clawed, inserted with the stamens on the calyx-tube. Stamens about 20, exserted, with purplish anthers. Pistil consisting of a 3-celled, inferior ovary surmounted by 3 distinct styles with capitate stigmas.

Fruit — A stalked, globose, berry-like, bright red pome, about ¼ of an inch in diameter, marked at the top by the persistent calyx-lobes, ripening in the autumn and persisting until the following spring unless devoured by birds. Flesh thin, acrid. Seeds light chestnut-brown, about ⅛ of an inch long.

Winter characters — Twigs rather stout, glabrous, somewhat glaucous, grayish to reddish brown, at length dark brown. Terminal bud ovate to broadly conical, somewhat curved, gummy and somewhat pilose without, dense-woolly within, dark purplish red, ¼–½ of an inch long. Lateral buds smaller, somewhat flattened and closely appressed. Mature bark thin, light gray, smooth or somewhat scaly.

Habitat — Prefers open, moist sites along lake shores, mountain streams, the margins of peat bogs and in damp woods, but thrives in drier situations on the thin soils of ledges and rocky hillsides.

Range — Newfoundland and southern Labrador westward to Manitoba, southward into the northern border states and along the Appalachian mountains to North Carolina. Zones C, D, and **E**.

Uses — Of no commercial importance. The tree has ornamental value, especially the "decora" variety, and is occasionally cultivated in the northeastern states and southern Canada. The inner bark and fruit possess some medicinal qualities.

European Mountain Ash, Rowan Tree

Pyrus Aucuparia (L.) Ehrh. [Sorbus Aucuparia L.]

1. A branch showing inflorescence and mature leaves x ½
2. A flower, lateral sectional view x 2½
3. A fruit cluster, lateral view x ½
4. Fruit, lateral sectional view x 2
5. Seed, lateral view x 3
6. Winter twig x ½

ROSACEAE

Pyrus Aucuparia (L.) Ehrh. [*Sorbus Aucuparia* L.]

European Mountain Ash, Rowan Tree

Habit — A small, quick-growing tree, usually 20–40 feet in height with a trunk diameter of 6–15 inches, under optimum conditions occasionally 60 feet tall, at the northern limits of its range in Eurasia often reduced to a small shrub. Trunk short, separating a few feet above the ground into stout, spreading branches to form a rounded crown.

Leaves — Alternate, odd-pinnately compound, 6–10 inches long, consisting of 9–15 sessile or nearly sessile leaflets arranged in pairs along a slender hairy petiole, the terminal leaflet stalked. Leaflets oblong to oblong-lanceolate, blunt or short-pointed at the apex, rounded and inequilateral at the base, serrate, ¾–2 inches long, ½–⅔ of an inch broad, at maturity dull green and somewhat pubescent above, paler and sparingly tomentose beneath.

Flowers — Appearing in June or July after the leaves are fully grown, perfect, about ⅓ of an inch in diameter, borne on short pedicels in compact, woolly cymes 4–6 inches in diameter. Calyx gamosepalous, obconic, with short, acute, pubescent lobes. Petals white, orbicular, short-clawed, inserted with the stamens on the calyx-tube. Stamens about 20, as long as the petals. Pistil 3–5-celled with a like number of distinct styles and capitate stigmas.

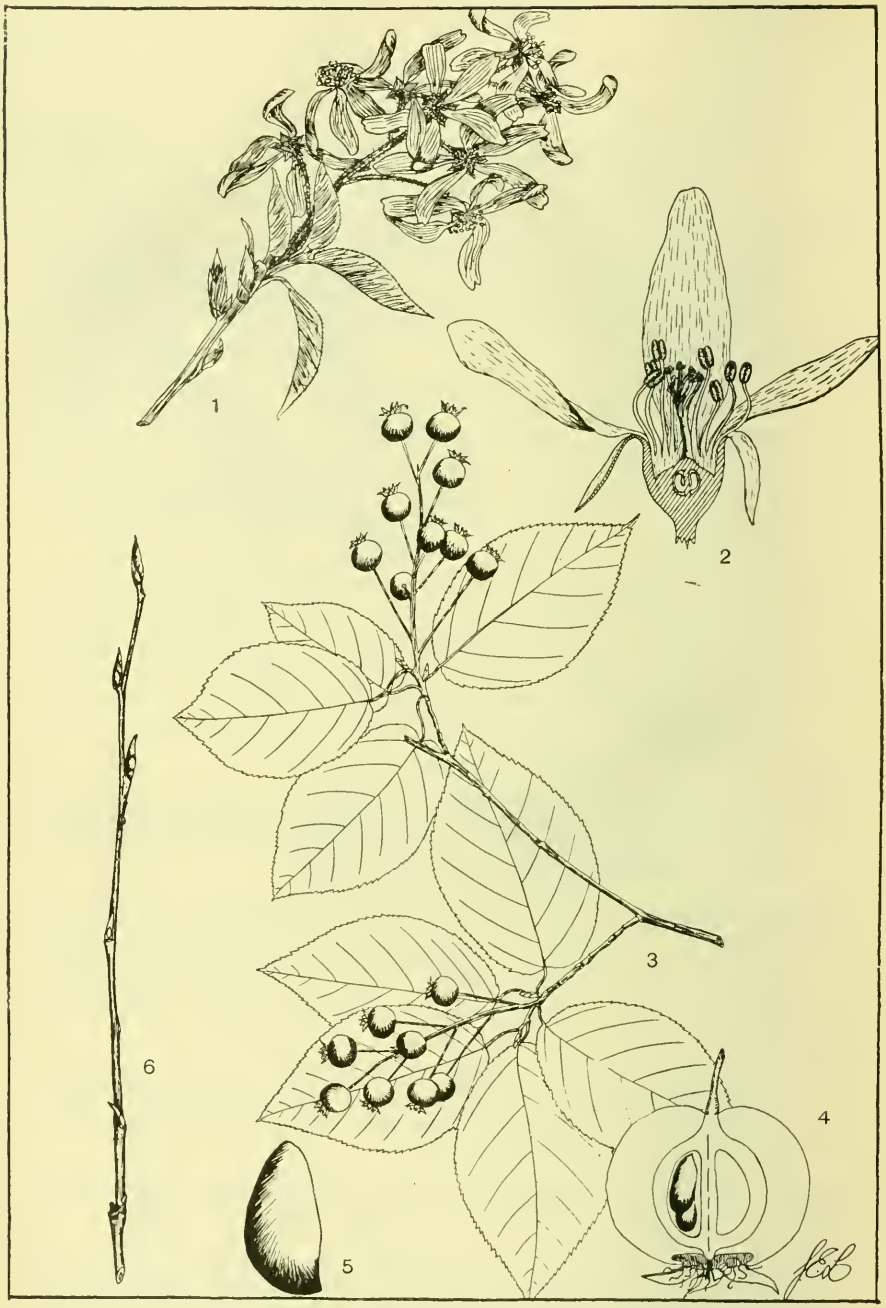
Fruit — A stalked, globose, berry-like, bright red pome, about ⅓ of an inch in diameter, marked at the top by the persistent calyx-lobes, ripening in the autumn and persisting into the winter unless devoured by birds. Seeds chestnut-brown, about ⅛ of an inch long.

Winter characters — Twigs rather stout, pubescent, grayish brown, at length dark brown. Terminal bud ovate, white-villous-tomentose, dark purplish red, ¼–½ of an inch long. Lateral buds smaller, somewhat flattened, closely appressed. Mature bark thin, dark gray, smooth or somewhat scaly.

Habitat — Widely planted in the northeastern states around the habitations of man as a shade and ornamental tree. The fruit is devoured by birds and wild trees thus sown are occasionally found along fences, in upland bogs, and around the borders of swamps.

Range — Through northern Europe to Western Asia and Siberia. Naturalized in the northeastern states and eastern Canada. Zones B and C.

Uses — Chiefly an ornamental species because of its showy white flowers and large clusters of bright red fruit which persist into the late fall and winter. Grown widely in the United States as a park tree, especially the various horticultural varieties. Wood hard, heavy, close-grained, light brown with paler sapwood. Used occasionally in the Old World for tool handles, agricultural implements, etc.



Shad Bush, Serviceberry, Juneberry

Amelanchier canadensis (L.) Medic.

1. A twig showing flowers and immature leaves x 1
2. A flower, lateral sectional view x 4
3. Branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 2½
5. Seed, lateral view x 5
6. Winter twig x ½

ROSACEAE

Amelanchier canadensis (L.) Medic.*

Shad Bush, Serviceberry, Juneberry

Habit — A small tree 20–30 feet in height with a trunk diameter of 6–12 inches, occasionally under optimum conditions 50 feet tall, at times shrubby and fastigiately branched. Trunk long, slender, usually straight and with slight taper. Crown narrow, oblong, round-topped, dense with many slender branches.

Leaves — Alternate, obovate to oblong or ovate-oval, 1⅜–4 inches long, ⅝–2 inches wide, acute or acuminate at the apex, cordate or rounded at the base, sharply and somewhat doubly serrate, at maturity thick, firm, glabrous, dull dark green above, paler and slightly pubescent on the veins beneath, borne on slender petioles ½–1 inch long.

Flowers — Appearing in April and May when the leaves are about one-third grown, perfect, ½–1 inch broad, borne on slender bibracteolate pedicels ½–1 inch long in erect or lax, tomentose racemes 3–4 inches long. Calyx-tube campanulate, quite smooth, 5-lobed, the lobes oblong-triangular, acute or obtuse, tomentose at least above. Petals white, linear-oblong or somewhat obovate, rounded or obtuse at the apex, inserted on the calyx-tube, ⅜–⅝ of an inch long. Stamens usually 20, shorter than the petals, the subulate filaments bearing oblong yellow anthers. Ovary smooth, inferior, 5-celled. Styles 3–5, connate below, bearing terminal stigmas.

Fruit — A globose, berry-like, glaucous, bright red pome, ⅓–½ of an inch in diameter, marked at the apex by the persistent calyx-lobes and stamen-filaments, borne on slender pedicels ⅜–1⅓ of an inch long, ripening in June or July and turning purplish red. Flesh dry, rather tasteless. Seeds numerous, small.

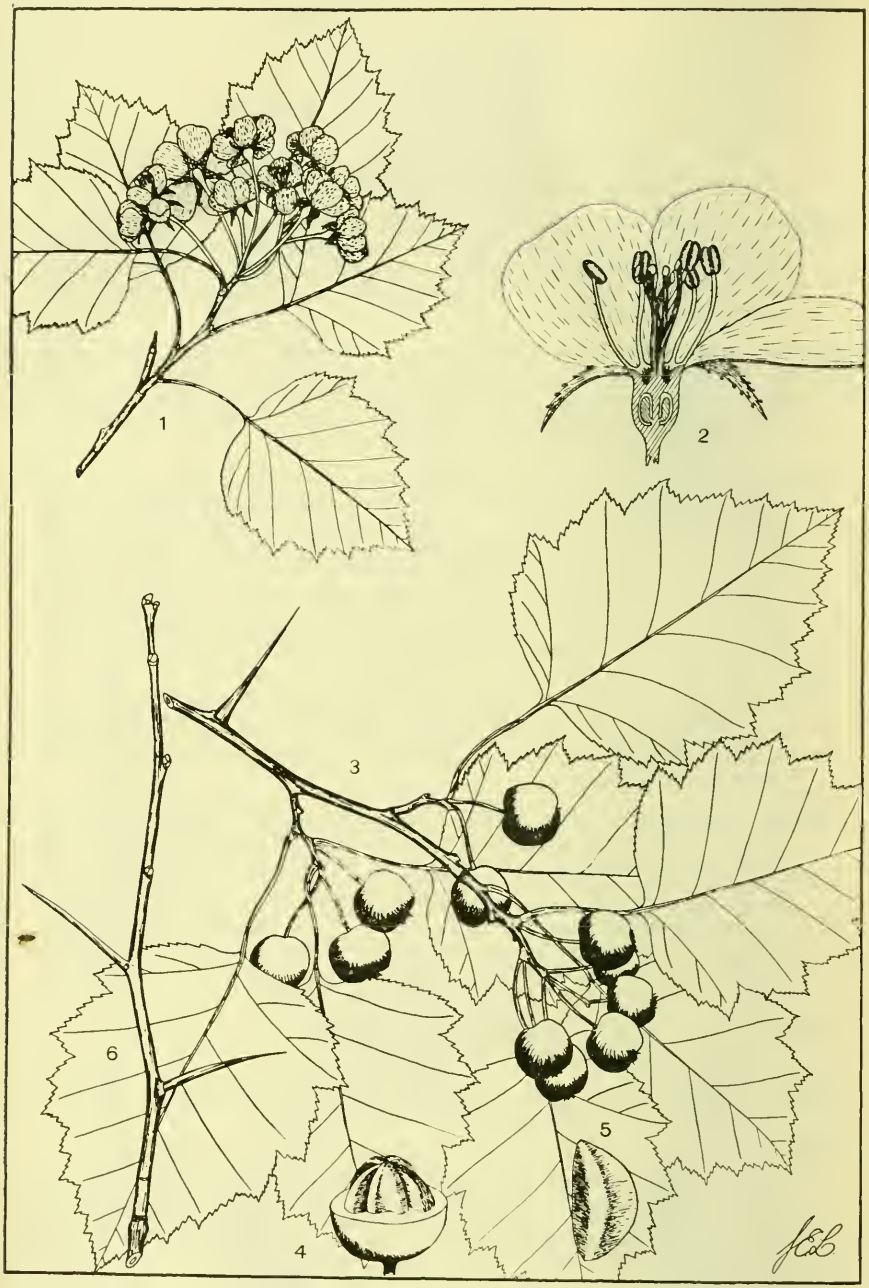
Winter characters — Twigs slender, somewhat zigzag, smooth but usually covered with a thin, grayish, evanescent outer layer, reddish brown with small minute lenticels, at length dark reddish brown. Terminal bud narrowly ovate to conical, acuminate, greenish or purplish brown, hairy at the apex and along the scale-margins, ¼–½ of an inch long. Lateral buds on vigorous twigs normal, smaller than the terminal bud, somewhat divergent. On slow-growing twigs the lateral buds are often rudimentary. Mature bark thin, smooth, grayish brown, on older trees divided by shallow fissures in narrow, scaly, longitudinal ridges.

Habitat — Dry banks and hillsides, open upland woods and limestone ridges, seemingly preferring calcareous soils.

Range — New Hampshire westward to Iowa, Kansas and Missouri, southward to Georgia and Louisiana. Zones A, B, and C.

Uses — Not a timber species because of its small size. Wood hard, heavy, strong, close-grained, dark brown often tinged with red, with thick, paler sapwood. Occasionally used for tool handles and in the manufacture of fishrods. The showy white flowers which appear in dense masses in early spring before the leaves have become green, render this species of ornamental value. The fruit is a favorite food of birds.

* A second arborescent species of *Amelanchier*, *A. lacris* Wieg., has been reported as occurring within the borders of New York State. This is found in moist, more protected places in ravines and gorges, seeming to avoid excessive isolation, and differs from *A. canadensis* in that the foliage has a bronze cast at blossom time (in contrast to the white-tomentose foliage of the other form), in its looser racemes with longer flower pedicels and petals, and in the larger, longer-stalked fruit.



Thorn Apple, Hawthorn

Crataegus pedicellata Sarg.

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 2
3. A branch showing mature leaves and fruit x ½
4. Fruit in section showing nutlets x 1½
5. Nutlet, lateral surface view x 2
6. Winter twig x ½

ROSACEAE

Crataegus pedicellata Sarg.

Thorn Apple, Hawthorn

Habit — A small tree 18–20 feet in height, with a trunk diameter of 6–12 inches and many slender, elongated, ascending or spreading branches which form a rounded, symmetrical, dense crown.

Leaves — Alternate, broadly ovate or sometimes obovate, 3–4 inches long, 2–3 inches wide, acute or acuminate at the apex, broadly cuneate or truncate at the base, divided above the middle in 4 or 5 pairs of short, pointed, divergent lobes, doubly serrate on the margin except toward the base, at maturity thin, dark green and scabrous above, paler and nearly glabrous below, borne on slender, glandular petioles 1½–2½ inches long.

Flowers — Appearing in late May and early June when the leaves are about half grown, perfect, ⅗–⅘ of an inch broad, borne on long, slender pedicels in loose, lax, many-flowered, somewhat villose corymbs. Calyx-tube urn-shaped, glabrous, 5-lobed, the lobes broad, acute, coarsely glandular-serrate, subsequently reflexed. Petals 5, white, obovate, rounded at the apex, contracted at the base, entire, inserted on the calyx-tube. Stamens 10, with elongated filaments and rose-colored anthers. Ovary inferior, 5-celled. Styles 5, surrounded at the base by a ring of tomentum. Stigmas capitate, terminal.

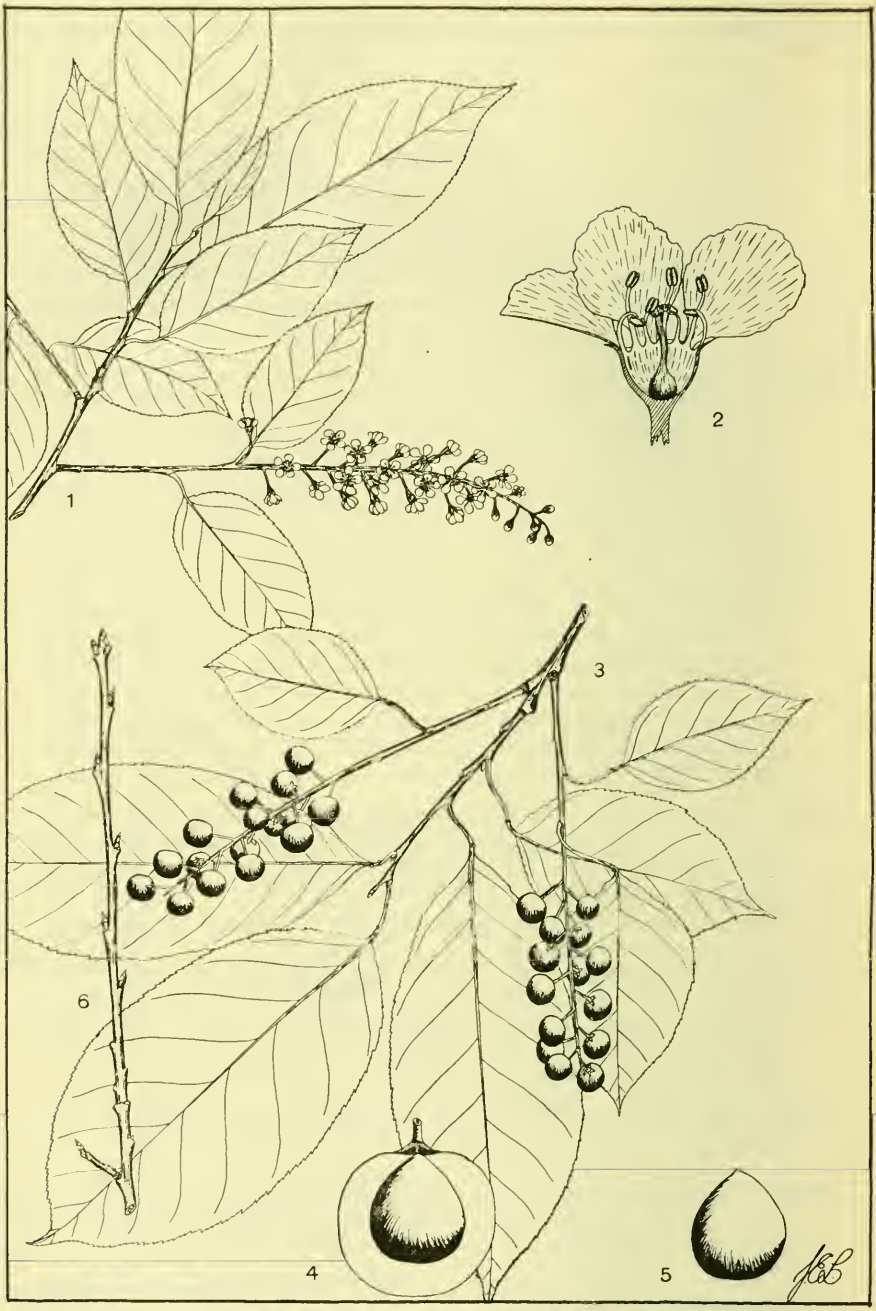
Fruit — An oblong, rounded, lustrous, dark punctate, bright scarlet pome, ⅗–⅘ of an inch long, marked at the apex by the persisting calyx-lobes and stamen-filaments, borne on slender pedicels in lax, few-fruited, glabrous, corymbose, clusters, deciduous in early autumn. Flesh thin, dry, mealy, enclosing 5 rounded, vertically-grooved, 1-seeded, bony nutlets.

Winter characters — Twig slender, somewhat zigzag, smooth, dark chestnut-brown and lustrous, becoming light gray the second season, armed with straight or slightly curved, lustrous spines 1½–2 inches long. Buds globose, bright-red, about ⅛ of an inch in diameter. Mature bark thin, close, reddish brown, scaly on the surface.

Habitat — A "weed" tree occurring in waste places along fence rows, in fence corners, old pastures, and open upland woods.

Range — Northeastern United States but imperfectly known. Said to occur from southern Connecticut to southern Ontario and Illinois, south to Pennsylvania and Delaware. Zones B and C.

Uses — Of no commercial importance. A tree "weed". Occasionally grown ornamentally in arboretums.



Wild Black Cherry, Rum Cherry

Prunus serotina Ehrh.

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 4
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 2
5. Stone, lateral view x 2
6. Winter twig x ½

ROSACEAE

Prunus serotina Ehrh.

Wild Black Cherry, Rum Cherry

Habit — The largest of the cherry trees occurring in the United States, commonly 50–75 feet in height with a trunk diameter of 2–3 feet, under favorable conditions sometimes 110 feet tall. Under forest conditions the bole is long, clean, with but slight taper. Trees in the open have a short bole which continues into the narrowly oblong, irregular crown.

Leaves — Alternate, oval, oblong-lanceolate or lance-obovate, 2–5 inches long, 1–1½ inches wide, acuminate at the apex, cuneate or rounded at the base, glandular-serrate with incurved teeth, at maturity thick, glabrous, dark green and lustrous above, paler and glabrous below, borne on slender, biglandular petioles ⅗–¾ of an inch long.

Flowers — Appearing in May or June when the leaves are nearly grown, perfect, ¼–⅓ of an inch broad, borne on short pedicels in many-flowered, erect or nodding racemes which are 3–6 inches long and terminate short leafy branches. Calyx-tube cup-shaped, glabrous or slightly puberulous, 5-lobed, the lobes ovate-oblong, obtuse, reflexed at maturity, persistent. Petals white, broadly obovate, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens with glabrous, filiform filaments and oval anthers. Pistil consisting of a green, glabrous, 1-celled ovary, thick style and clavate stigma.

Fruit — A globose, short-stalked, dark red, lustrous drupe, ¼–⅓ of an inch in diameter, borne in drooping racemose clusters, ripening in August and September and turning dark purple or black. Skin thick. Flesh thin, juicy, dark purple, of a vinous flavor when fully ripe. Stone obovate, thin-walled, ridged on one side.

Winter characters — Twigs slender, glabrous, reddish or grayish brown, marked with numerous, pale lenticels, often covered in part with a thin, grayish, evanescent skin which rubs off easily. Bruised twigs have the odor and taste of bitter almonds. Buds ovate, acute, somewhat lustrous, chestnut-brown, divergent or flattened and appressed, ⅛–⅙ of an inch long. Mature bark thin, dark reddish brown, reticulately fissured into small, scaly, persisting plates with upraised edges.

Habitat — A long-taprooted species requiring a deep soil. Prefers the moist alluvial soils of river-bottoms and fertile slopes but occurs in drier situations on a variety of soils. Under forest conditions it usually grows solitary or in small groves, intermixed with other species.

Range — Nova Scotia westward through southern Canada to South Dakota, south to Florida and eastern Texas. Zones A, **B**, C, and D.

Uses — One of the most valuable timber trees of the forests of the eastern United States. Wood rather hard, light, strong, close-grained, pale reddish brown with thin yellow sapwood. Valuable for furniture, cabinet making and interior finish. Supply largely depleted through inroads made by furniture manufacturers. The delicate, nodding racemes of small, white flowers and dark green, subcoriaceous leaves render this species of ornamental value.

Choke Cherry

Prunus virginiana L.

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 4
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 2
5. Stone, lateral view x 2
6. Winter twig x ½

ROSACEAE

Prunus virginiana L.

Choke Cherry

Habit — A shrub or small tree 20–25 feet in height with a trunk diameter of 4–8 inches, occasionally 35 feet tall with a bole 12 inches through. Trunk usually inclined. Crown narrow, irregular.

Leaves — Alternate, ovate, elliptical or obovate, 2–4 inches long, 1–2 inches wide, abruptly acute at the apex, cuneate or rounded at the base, sharply serrate with slender, sharp teeth, at maturity thin, bright green and glabrous above, paler and quite glabrous beneath, borne on slender, biglandular petioles 2/5–4/5 of an inch long.

Flowers — Appearing in May or June when the leaves are nearly grown, perfect, 1/3–1/2 of an inch broad, borne on short pedicels in many-flowered erect or nodding racemes which are 3–6 inches long and terminate short leafy branches. Calyx-tube cup-shaped, glabrous, 5-lobed, the lobes short, broad, obtuse, reflexed, early deciduous. Petals 5, white, orbicular, short-clawed at the base and inserted with the stamens on the calyx-tube. Stamens with filiform filaments and oval anthers. Pistil consisting of a green, glabrous, 1-celled ovary, short thick style and broad, simple stigma.

Fruit — A globose, short-stalked, bright red, lustrous drupe, 1/4–1/3 of an inch in diameter, borne in drooping racemose clusters, ripening in July and August and turning dark crimson or nearly black. Skin thick. Flesh thin, juicy, dark colored, very puckery until dead ripe. Stone globose, apiculate, ridged on one side.

Winter characters — Twigs slender to medium stout, glabrous, light brown to reddish brown, with small, punctate, pale yellowish lenticels. Bruised twigs with rank odor. Buds conical to ovate, acute, glabrous, pale chestnut-brown, 1/6–1/3 of an inch long. Mature bark thin, grayish brown, smooth aside from the rounded lenticels, in age somewhat roughened by shallow ridges.

Habitat — On a variety of soils along fences, highroads, stream courses, in open woods, and waste land, often forming extensive thickets. Spreads by means of root-suckers or by seeds disseminated by the birds.

Range — A transcontinental species extending from Newfoundland westward through the Hudson Bay region to British Columbia and the coast, southward to Georgia and along the eastern slopes of the Rockies to Texas and New Mexico. Zones B, C, and D.

Uses — An obnoxious "weed" shrub and tree. The seeds are sown by the birds along fences and hedge rows and soon produce extensive thickets which are difficult to eliminate owing to the formation of numerous root-suckers. Of no commercial value. The appellation of "Choke Cherry" is apropos because of the puckery nature of the fruit before it becomes dead ripe.

Wild Red Cherry, Bird Cherry, Fire Cherry, Pin Cherry

Prunus pennsylvanica L. f.

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 3
3. A branch showing mature leaves and fruit x ½
4. Portion of leaf-margin, enlarged.
5. Fruit, lateral sectional view x 2 ½
6. Stone, lateral view x 2½
7. Winter twig x ½

ROSACEAE

Prunus pennsylvanica L. f.

Wild Red Cherry, Bird Cherry, Fire Cherry, Pin Cherry

Habit — Usually a shrub or small tree 20–30 feet in height with a trunk diameter of 6–10 inches, under optimum conditions occasionally 40 feet tall. Trunk short, continuous into the crown. Crown narrowly oblong, somewhat rounded at the top, consisting of slender ascending branches.

Leaves — Alternate, oblong-lanceolate and occasionally slightly falcate, 3–4½ inches long, ¾–1¼ inches wide, acute or acuminate at the apex, rounded or cuneate at the base, finely serrate with incurved teeth, at maturity bright green, smooth and lustrous above, paler and smooth below, borne on slender, glabrous petioles ½–1 inch long.

Flowers — Appearing in May or early June when the leaves are about one-fourth grown, perfect, about ½ of an inch broad, borne on slender pedicels about 1 inch long in 4–5-flowered, short pedunculate, 2–3-clustered umbels. Calyx-tube urn-shaped, glabrous, 5-lobed, the lobes oblong, obtuse, red-margined, reflexed at maturity. Petals 5, creamy white, nearly orbicular, clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with long filiform filaments and oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary inserted in the bottom of the calyx-tube, a filiform style and broad, simple stigma.

Fruit — A globose, long-stalked, thick-skinned, light red drupe, about ¼ of an inch in diameter, maturing in July and early August. Flesh thin, sour. Stone oblong, apiculate at the apex, thin-walled, slightly compressed, ridged on one side.

Winter characters — Twigs slender, glabrous, bright red and lustrous or partly covered with a grayish, evanescent skin, with prominent, pale lenticels. Broken twigs have a characteristic bitter taste and odor. Buds ovate, obtuse, reddish brown, clustered at the twig-tip and sometimes along the sides, about 1/12 of an inch long. Mature bark thin, reddish brown, smooth aside from the large, horizontally elongated lenticels. Inner bark bright green.

Habitat — A "weed" tree widely distributed through seeds scattered by the birds. Occurs in fence rows, abandoned pastures, along road sides and on limestone outcrops. Comes in rapidly in burns and slashes after deforestation, providing a temporary ground cover until overshadowed by the more important timber species.

Range — Newfoundland westward to British Columbia, southward along the mountains to Georgia and Tennessee, and through the Lake States. Zones A, B, C, and **D**.

Uses — Not a timber species. Its chief value lies in its ability to establish itself rapidly after deforestation and forest fires, protecting the soil and acting as a nurse-tree until other larger and more permanent species occupy the site.

Black Thorn, Bullace Plum, Sloe

Prunus institutia L. [Prunus spinosa, var. institutia Gray]

1. A twig showing flowers and immature leaves x ½
2. Flower, lateral sectional view x 2½
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 2
5. Stone, lateral view x 2
6. Winter twig x ¼

ROSACEAE

Prunus instititia L. [Prunus spinosa, var. instititia Gray]

Black Thorn, Bullace Plum, Sloe

Habit — Generally a bushy shrub 2–15 feet high with short, stiff, spiny branches forming a dense, compact top, occasionally a small tree 20–25 feet in height with a trunk diameter of 5–8 inches and a narrow, compact, rounded crown.

Leaves — Alternate, oblanceolate to obovate, 1½–2 inches long, broadly acute at the apex, attenuate at the base, sharply and somewhat doubly serrate, at maturity firm, dark green and glabrous above, paler and pubescent below, borne on slender petioles, ⅖–⅗ of an inch long.

Flowers — Appearing in April or May with the leaves, perfect, about ½ of an inch broad, borne solitary or in 2–3-flowered, umbellate clusters from lateral buds on the growth of the preceding season. Calyx-tube campanulate, green, glabrous, 5-lobed, the lobes narrow and acute. Petals 5, elliptical, blunt at the apex, inserted with the stamens on the calyx-tube. Stamens about 30, with filiform filaments and oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary, a long filamentous style, and capitate stigma.

Fruit — A globular, glaucous, deep blue or nearly black drupe, ⅖–½ of an inch in diameter maturing in July but usually persisting until winter, scarcely edible. Flesh thin, acidulous. Stone oval, somewhat compressed, grooved on one side.

Winter characters — Twigs slender, glabrous, lustrous, dark brown, at length becoming dark gray. Lateral spinescent spurs well devolped. Terminal bud absent. Lateral buds ovate, acute, light brown, ⅛–⅓ of an inch long. Mature bark thin, quite smooth, nearly black.

Habitat — An "escape" that has become established along highroads, fence rows and in waste places.

Range — Central and southern Europe, northern Africa and western Asia. Naturalized in New England, Long Island, Pennsylvania, New Jersey, and possibly elsewhere. Zones A, B, and C.

Uses — Occasionally used as a hedge plant because of its dense habit and spiny branches, but objectionable as it produces root-suckers in abundance. A double-flowered form is propagated in this country for ornamental purposes. Wood hard, heavy, close-grained, reddish brown with paler sapwood. Used abroad in the manufacture of furniture and for cabinet work.

Mahaleb Cherry, St. Lucie Cherry

Prunus Mahaleb L.

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 2½
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 2
5. Stone, lateral view x 2
6. Winter twig x ½

ROSACEAE

Prunus Mahaleb L.

Mahaleb Cherry, St. Lucie Cherry

Habit — A small, slender tree 20–25 feet in height with a trunk diameter of 6–12 inches, or a flowering shrub. Bole short, breaking up a short distance above the ground into stout, ascending branches to form a broad, low, rounded crown.

Leaves — Alternate, round-ovate to orbicular, 1–2 inches in diameter abruptly sharp-pointed at the apex, rounded or somewhat cordate at the base, finely glandular-serrate, at maturity thin, firm, light green, smooth and somewhat glaucous on both sides, fragrant, borne on slender petioles ½–1 inch long.

Flowers — Appearing in May and June when the leaves are partly grown, perfect, white, about ½ of an inch broad, borne on stout pedicels in several-flowered, racemose corymbs terminal on short leafy branches of the year. Calyx-tube urn-shaped, glabrous, with 5 strongly reflexed lobes. Petals 5, white, obovate, obtuse, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with slender filaments and oblong anthers. Pistil green, glabrous, consisting of a 1-celled ovary, long style, and broad, simple stigma.

Fruit — A depressed-globose or globose-ovoid, long-stalked, reddish black and lustrous, unpalatable drupe, about ⅓ of an inch in diameter, ripening in early summer. Flesh thin, firm, bitter. Stone small, globose, slightly compressed.

Winter characters — Twigs slender, glabrous, grayish red and lustrous, fragrant. Buds ovate, acute, grayish red, those near the branch-tip somewhat clustered. Mature bark thin, close, dark gray, somewhat roughened by shallow ridges.

Habitat — In waste places along roadsides, fence rows, and about abandoned homesteads, preferring a moist, rich soil.

Range — Native to middle and southern Europe. Sparingly naturalized in southern New York and southward. Zones A and B.

Uses — Introduced from abroad as a stock on which to graft garden cherries. Wood hard, heavy, close-grained, fragrant, dark red. Prized abroad as a cabinet wood and for the manufacture of small trinkets. The species has ornamental value but is seldom used here.

Sweet Cherry, Mazzard

Prunus avium L.

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 1½
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 1½
5. Stone, lateral view x 1½
6. Winter twig x ½

ROSACEAE

Prunus avium L.

Sweet Cherry, Mazzard

Habit — A medium-sized tree usually 30–50 feet in height with a trunk diameter of 1–2 feet, under favorable conditions sometimes 75 feet tall. Trunk tapering, continuous into the crown. Lateral branches slender, ascending, beginning a few feet above the ground, forming a narrowly pyramidal crown which becomes broad-spreading in age.

Leaves — Alternate, oblong-ovate to obovate, 2–4½ inches long, abruptly short acuminate at the apex, rounded or slightly cordate at the base, irregularly serrate, at maturity thin, rather flaccid, glabrous, dull dark green above, paler and pubescent on the veins beneath, borne on slender petioles ⅘–1 inch long.

Flowers — Appearing in April and May with the leaves, perfect, about 1 inch broad, borne on slender pedicels in 2–5-flowered, lateral, sessile umbels. Calyx-tube campanulate, glabrous, reddish at the top, 5-lobed, the lobes oblong, obtuse, reflexed. Petals 5, white, orbicular, shallowly notched at the apex, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with long, filiform filaments and oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary, long style, and broad, simple stigma.

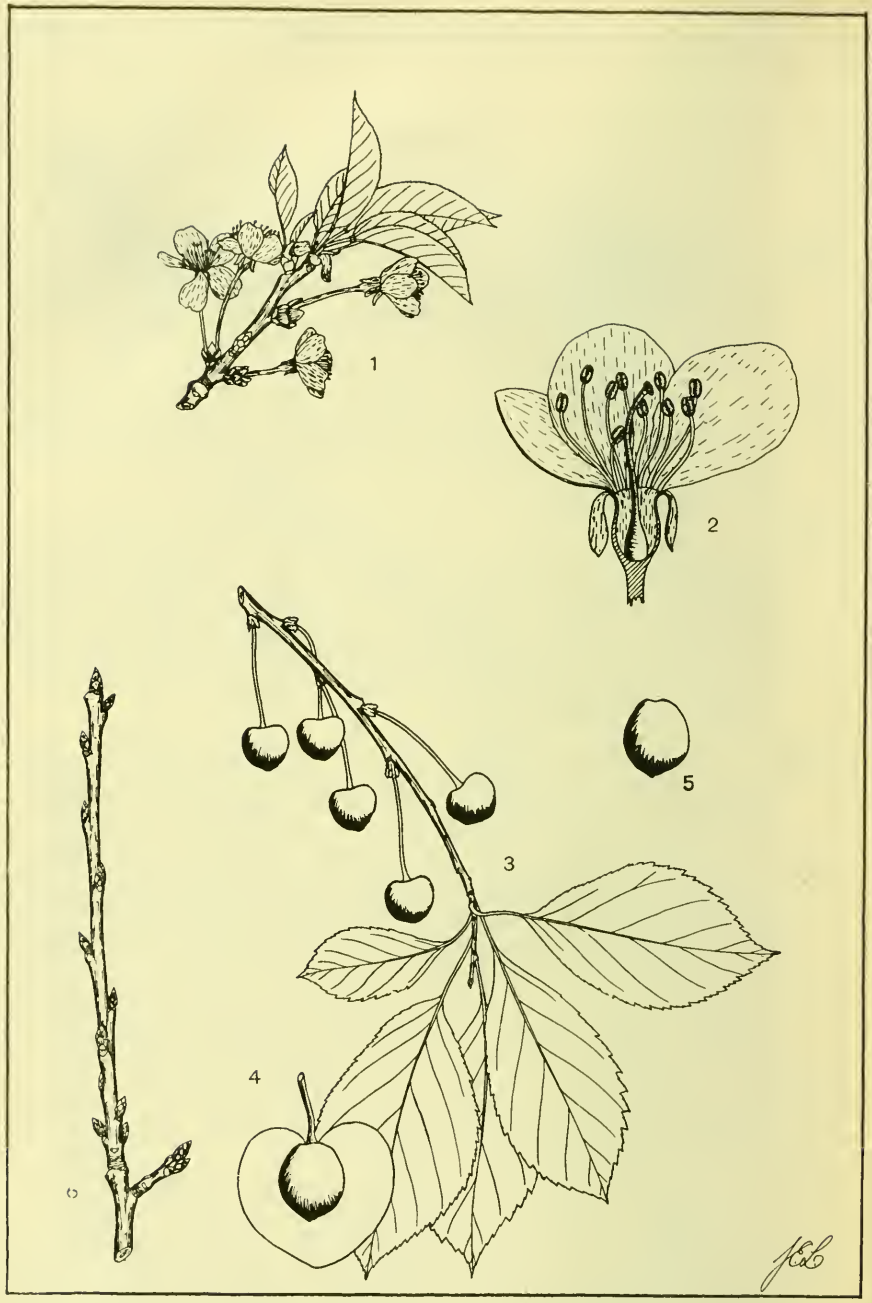
Fruit — A depressed-globose, long-stalked, dark red or nearly black drupe, about ½ of an inch in diameter in the wild form, usually borne in clusters, appearing in June or July. Flesh sweet or somewhat tart, adhering to the globose or ovoid stone.

Winter characters — Twigs stout, glabrous, light reddish brown and lustrous, or partly covered with a grayish, evanescent skin, with characteristic bitter taste and odor when broken. Older twigs with short, stout, fruit-spurs marked with many leaf-scars and terminally clustered buds. Buds ovate, acute, divergent, glabrous, reddish brown, clustered near the tips of the fruit-spurs or scattered on vigorous shoots, ⅕–¼ of an inch long. Outer bark thin, reddish brown, smooth aside from the prominent, horizontally elongated lenticels, peeling off transversely to expose the lighter inner bark. Mature bark in old trees roughened with shallow ridges.

Habitat — An "escape" in waste places along fences, hedge rows, roadsides, and in open woods. Widely disseminated through the agency of birds and hence known as European Bird Cherry.

Range — A native of southern Europe but now widely naturalized in eastern United States. Frequent in New York State. Zones A, B, and C.

Uses — Many of the cultivated garden cherries have been derived from this species. Ornamental varieties, including double-flowered forms, may be purchased from nurserymen. Wood heavy, rather soft, brittle, close-grained. Used abroad for the manufacture of furniture, musical instruments and in turnery.



Sour Cherry, Morello Cherry

Prunus Cerasus L.

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 2
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 1½
5. Stone, lateral view x 1½
6. Winter twig x ½

ROSACEAE

Prunus Cerasus L.

Sour Cherry, Morello Cherry

Habit — A small tree 20–30 feet in height with a trunk diameter of 10–12 inches, occasionally under favorable conditions 40 feet in height. Bole seldom more than 4–6 feet long, breaking up into stout, ascending, spreading branches to form a broad, low, rounded crown.

Leaves — Alternate, ovate-lanceolate to narrowly obovate, 2½–4 inches long, 1–1¾ inches wide, acuto or abruptly acuminate at the apex, rounded or cuneato at the base, unequally crenate-serrate, at maturity thick, firm, smooth, dark green and lustrous above, paler and smooth below, borne on slender, usually biglandular petioles ½–1 inch long.

Flowers — Appearing in April or May with the leaves, perfect, about 1 inch broad, borne on slender pedicels in 1–5-flowered, lateral, sessile umbels which are scaly at the base from the persisting appressed scales of the flower-buds. Calyx-tube urn-shaped, glabrous, 5-lobed, the lobes oblong, obtuse, minutely glandular-serrate and reflexed. Petals 5, white, broadly obovate and sometimes notched at the summit, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with long filiform filaments and oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary, long style and broad, simple stigma.

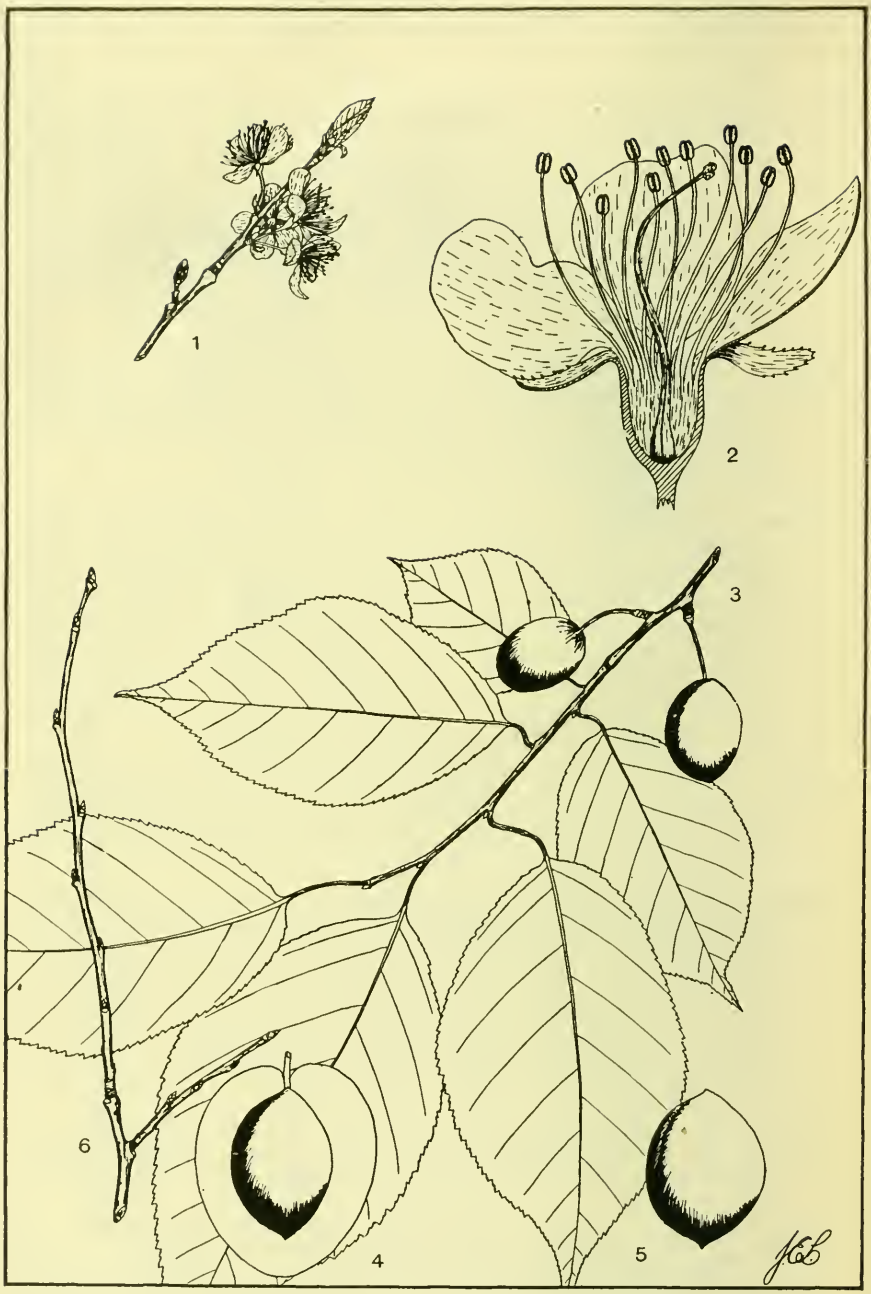
Fruit — A depressed-globose, long-stalked, red or reddish black drupe, about ½ of an inch in diameter in the wild form, maturing in June or July. Flesh juicy, sour. Stone subglobose, apiculate at the apex, slightly ridged on one side.

Winter characters — Twigs rather stout, glabrous, red or grayish brown and somewhat lustrous or partly covered with a grayish evanescent skin, with characteristic bitter taste and odor when broken. Older twigs with short, stubby fruit-spurs. Buds ovate, acute, reddish brown, clustered near the tips of the fruit-spurs or scattered along vigorous shoots, about ⅕ of an inch long. Outer bark thin, reddish brown, smooth aside from the prominent, horizontally elongated lenticels, soon peeling back to expose the rougher inner bark.

Habitat — In rich, moist soil about abandoned homesteads, along fences and roadsides and the margins of woods. Spreads readily from seeds or root-suckers.

Range — A native of southern Europe but now widely naturalized as an "escape" in the eastern United States. Zones A, B, and C.

Uses —. The importance of the species lies chiefly in its horticultural value as the source of various varieties of canning cherries. Wood heavy, rather soft, brittle, close-grained. Used in Europe for furniture and interior finish.



Canada Plum, Red Plum

Prunus nigra Ait.

1. A twig showing flowers and leaf-buds x ½
2. A flower, lateral sectional view x 4
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 1
5. Stone, lateral view x 1
6. Winter twig x ½

ROSACEAE

Prunus nigra Ait.

Canada Plum, Red Plum

Habit — A shrub or occasionally a small, bushy tree 20–30 feet in height with a trunk diameter of 5–6 inches. Bole short, dividing 5–6 feet above the ground into a number of stout, ascending limbs to form a low-spreading, rounded top of many rigid, more or less contorted branches and zigzag twigs.

Leaves — Alternate, oblong-ovate to obovate, 3–5 inches long, 1½–3 inches wide, abruptly acuminate at the apex, rounded or somewhat cuneate at the base, unequally crenulate-serrate with gland-tipped teeth, at maturity thick, firm, dull dark green and glabrous above, paler, somewhat pubescent and with prominent midrib beneath, borne on stout, usually biglandular petioles ½–1 inch long.

Flowers — Appearing in April or May before the leaves, perfect, ⅗–1 inch broad, borne on red pedicels ⅖–⅘ of an inch long in 3–5-flowered, lateral glabrous umbels. Calyx-tube urn-shaped, dark red without, bright red within, 5-lobed, the lobes lanceolate, glandular-toothed, usually somewhat pubescent above, reflexed after anthesis. Petals 5, white fading to pink with age, orbicular-obovate, rounded and somewhat erose at the apex, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with long, filiform filaments and small, oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary inserted in the bottom of the calyx-tube, a filiform style, and broad, simple stigma.

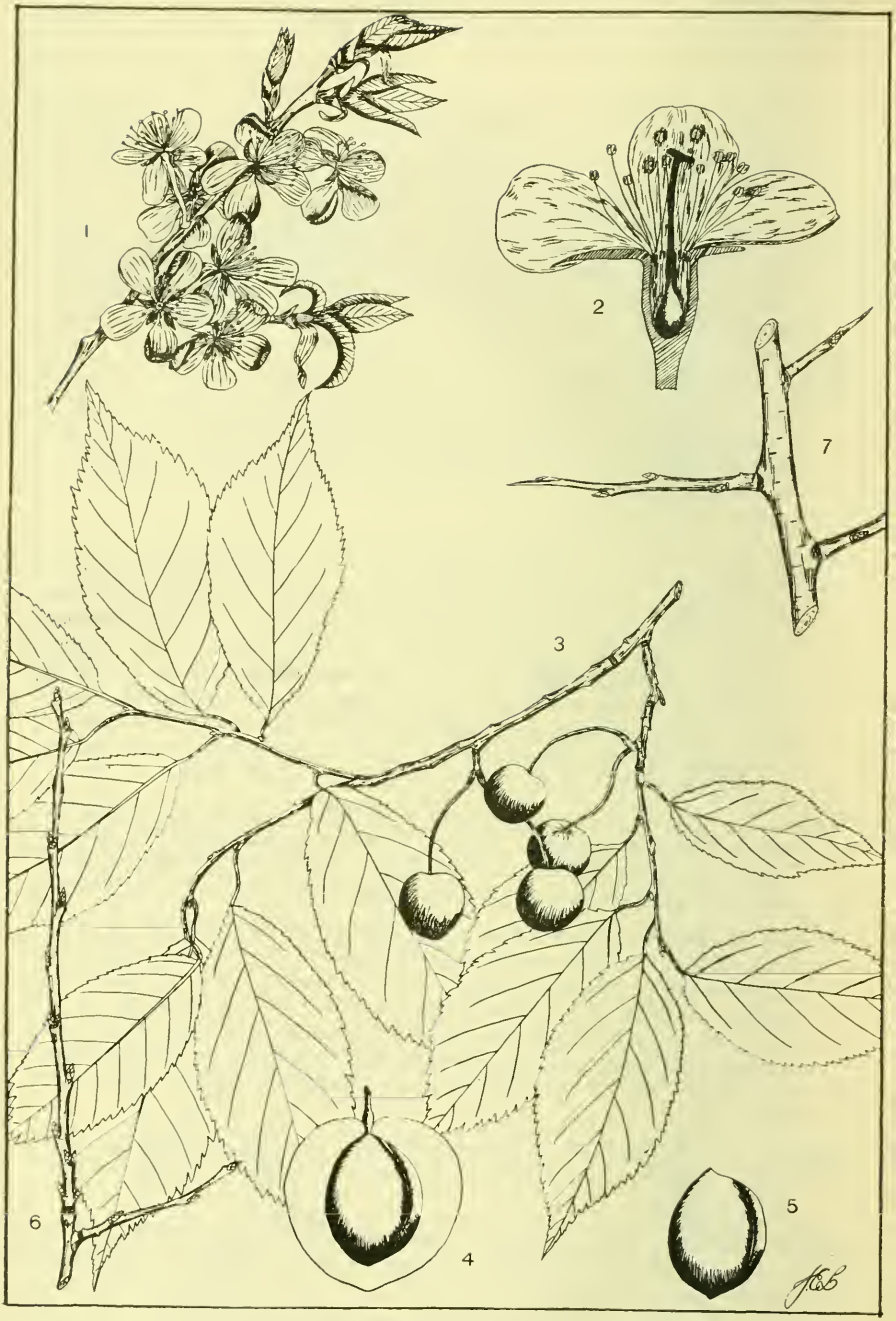
Fruit — An oval or oblong-oval, slightly glaucous, thick-skinned, orange-red drupe, 1–1¼ inches long, ripening during the latter half of August. Flesh yellow, sour, adhering to the stone. Stone oval, thick-walled, compressed, slightly grooved on one side. Seed ovate, light brown, compressed.

Winter characters — Twigs rather stout, slightly zigzag, glabrous or somewhat puberulous, dark reddish brown and partly covered with a grayish, evanescent skin. Lateral spinescent spurs usually present. Terminal bud absent. Lateral buds conical, acute, chestnut-brown, about ⅙ of an inch long. Mature bark thin, light grayish brown, at first smooth and marked with prominent, horizontally elongated lenticels, soon splitting and curling back in thick-layered plates exposing the darker, inner scaly bark.

Habitat — A "weed" tree preferring moist sites along fence rows, abandoned pastures, and in open glades and the margin of woods. Thrives on limestone outcrops.

Range — Newfoundland westward through southern Canada to Minnesota, southward into New England, Pennsylvania, Ohio, Indiana, Illinois, and Iowa. Zones A, **B**, and C.

Uses — Occasionally cultivated for its showy flowers in southern Canada and the northeastern states. Several varieties of cultivated plums have been derived from this species by horticulturists.



Wild Plum, Wild Yellow Plum

Prunus americana Marsh.

1. A twig showing flowers and leaf-buds x ½
2. A flower, lateral sectional view x 2½
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 1½
5. Stone, lateral view x 1¼
6. Winter twig x ½
7. Portion of branch showing spinose twigs x ½

ROSACEAE

Prunus americana Marsh.

Wild Plum, Wild Yellow Plum

Habit — A shrub or small tree 20–35 feet in height with a maximum trunk diameter of 12 inches. Trunk short, usually dividing 4–5 feet above the ground into many slender, spreading, slightly drooping branches which form a broad, rather deep crown.

Leaves — Alternate, elliptical to narrowly obovate, 2–4 inches long, ¾–1½ inches wide, acuminate at the apex, cuneate or rounded at the base, sharply doubly serrate, at maturity thick, firm, dark green and somewhat scabrous above, paler and glabrous or pubescent below, borne on slender, eglandular petioles ½–⅔ of an inch long.

Flowers — Appearing in April or May when the leaves are about one-third grown, perfect, about 1 inch broad, ill-scented, borne on slender pedicels ⅓–⅔ of an inch long in 2–5-flowered lateral, glabrous umbels. Calyx-tube narrow, urn-shaped, light red and glabrous or puberulous without, green within, 5-lobed, the lobes acuminate and reflexed after anthesis. Petals 5, white, obovate, rounded and irregularly erose at the top, with short red claws at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with long filiform filaments and small, oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary inserted in the bottom of the calyx-tube, a filiform style, and broad, simple stigma.

Fruit — A subglobose or globose-oblong, glabrous, pale punctate, thick-skinned, bright red drupe, ¾–1 inch in diameter, maturing in late summer or early autumn. Flesh succulent, sour, adhering to the stone. Stone oval, thick-walled, slightly grooved on one side. Seed oval light brown.

Winter characters — Twigs rather stout, glabrous or slightly pubescent, pale orange-brown, at length smooth and reddish brown. Lateral spinescent spurs usually present. Terminal bud absent. Lateral buds broadly conical, acute, brown, about ⅛ of an inch long, the margins of the bud-scales ciliate. Mature bark thin, light reddish brown, breaking up into large, thin, persisting plates.

Habitat — Prefers rich soil in moist situations along stream courses, in hedge rows and fence corners, or the borders of swamps, often forming extensive thickets, more rarely on dry limestone outcrops.

Range — Central New York westward to Montana and Colorado, south to Florida and eastern Texas. Zones A, **B**, and C.

Uses — Not a timber species because of its diminutive size. Various varieties are cultivated ornamentally for their showy blossoms and bright green foliage, and for their fruit which has been greatly improved by selection. The tart fruit of the wild form is sometimes made into preserves.

Plum

Prunus domestica L. [Prunus communis Huds.]

1. Portion of a twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 2
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x ¾
5. Stone, lateral view x ¾
6. Winter twig x ½

ROSACEAE

Prunus domestica L. [Prunus communis Huds.]

Plum

Habit — A small tree attaining a height of 20–25 feet with a trunk diameter of 5–8 inches, or many times shrubby and forming extensive thickets. Trunk short, dividing 4–8 feet above the ground in stout, ascending limbs and many spreading, slender, slightly drooping branches to form a low, rounded crown.

Leaves — Alternate, varying greatly in form from ovate or oval to obovate, 2–3½ inches long, broadly acute at the apex, cuneate at the base, coarsely and irregularly serrate, at maturity thick, firm, dull dark green and somewhat rougose above, pale, soft pubescent below, borne on stout petioles ½–1 inch long.

Flowers — Appearing in April or May with the leaves, perfect, about 1 inch broad, borne solitary or in 2–3-flowered, umbellate clusters from lateral buds on the growth of the preceding season. Calyx-tube cup-shaped, green, glabrous, 5-lobed, the lobes ovate, acute, reflexed after anthesis. Petals white, oval or obovate, rounded at the apex, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens about 30, with filiform filaments and oval anthers. Pistil green, glabrous, consisting of a 1-celled ovary, a long, filamentous style, and capitate stigma.

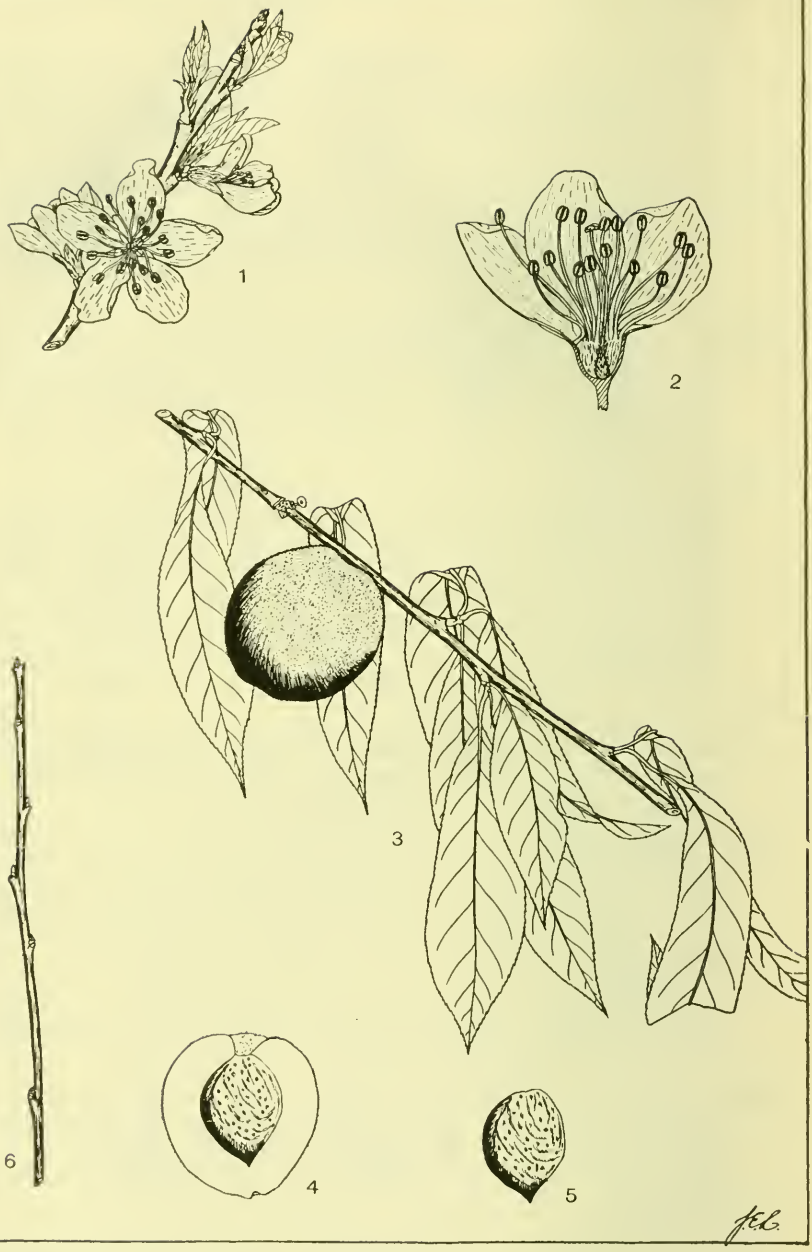
Fruit — A drupe, very variable in size, shape and color, ripening during August. It is commonly about an inch long, glaucous, and blue or bluish black in color. Stone large, slightly roughened, prominently grooved on one side.

Winter characters — Twigs rather stout, pubescent at least at first, reddish to grayish brown. Lateral spinulose spurs often present. Terminal bud absent. Lateral buds ovate, acute, appressed light brown, about ¼ of an inch long. Mature bark thin, grayish or brownish black, breaking up into large, thin, persisting plates.

Habitat — Prefers rich, moist soil but grows on a variety of sites about the habitations of man, along roads and fences, and borders of woods, often forming extensive thickets.

Range — Point of origin obscure but probably originally from the region of the Caucasus. It is held by some that *P. domestica* never existed in the wild form but that it is purely a horticultural species. Now widely cultivated in the Old and New World, often becoming an "escape." Zones A, B, and C.

Uses — The source of the "old time" or garden plums. Various ornamental varieties, including the double-flowered and variegated-leaved forms are propagated by nurserymen. The wood is hard, heavy, close-grained, reddish brown with pale sapwood. It is used abroad in cabinet work and for trinkets.



Peach

Prunus Persica (L.) Stokes.

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 1
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x ½
5. Stone, lateral view x ½
6. Winter twig x ½

ROSACEAE

Prunus Persica (L.) Stokes.

PEACH

Habit — A small tree usually about 20 feet in height with a trunk diameter of 5–6 inches, occasionally 25–30 feet tall. Bole short, breaking up 2–4 feet from the ground into stout, ascending limbs and branches to form a low, broad, globose crown.

Leaves — Alternate, lanceolate, oblong-lanceolate or oblanceolate, acuminate at the apex, tapering at the base, sharply serrate, at maturity light green, glabrous and lustrous above, paler and glabrous beneath, borne on stout petioles ⅕–⅖ of an inch long.

Flowers — Appearing in April and May before the leaves, solitary, perfect, ½–2 inches broad, borne laterally on short pedicels from scaly buds formed the previous season in the leaf-axils. Calyx-tube cup-shaped, pubescent within, 5-lobed, the lobes obovate, acute, purplish green. Petals pink, oval, obtuse at the apex, short-clawed at the base, inserted with the stamens on the calyx-tube. Stamens 20–30, with long slender filaments and oval anthers. Pistil sessile, inserted at the base of the calyx-tube, consisting of a 1-celled pubescent ovary surmounted by a simple style and small capitate stigma.

Fruit — A short-stalked, globose, laterally grooved, velvety-tomentose, yellowish green drupe 1–3 inches in diameter, maturing in late summer or early autumn and becoming roseate or reddish pink. Flesh thick, aromatic, mildly acidulous and sweet, adhering to or free from the stone. Stone ovoid, laterally compressed, apiculate at one end, deeply wrinkled and pitted. Seed aromatic, rather bitter, pale brown.

Winter characters — Twigs medium stout, glabrous, lustrous, pale punctate-lenticellate, greenish or reddish purple where exposed to direct sunlight, green below. Bruised twigs with the odor and taste of bitter almonds. Flower- and leaf-buds separate. Leaf-buds ovate, obtuse, densely pale woolly-tomentose, about ⅛ of an inch long. Flower-buds stouter than the leaf-buds, usually accessory and lateral to the leaf-buds. Mature bark thin, dark reddish brown, smooth aside from the prominent, horizontally elongated lenticels, becoming rougher and scaly at the base of the bole.

Habitat — An "escape" in waste places along fences, high roads and about the habitations of man, preferring protected sites where the climate is ameliorated by the proximity of large bodies of water.

Range — Supposed originally to have been a native of eastern Asia but long cultivated in North America for its fruit. The wild form has become naturalized as an "escape" in eastern United States. Zones A and B.

Uses — This species in its numerous varieties produces the peaches of commerce. Two well-marked strains, the "cling stones" and the "free stones" have been evolved. The fruit of the wild form is far inferior to that of the cultivated forms. Double-flowered dwarf forms with conspicuous flowers, etc., are grown ornamentally. During the World War, peach pits were used in the manufacture of gas masks.

Kentucky Coffee Tree

Gymnocladus dioica (L.) K. Koch [Gymnocladus canadensis Lam.]

1. An inflorescence from the staminate tree x ½
2. A staminate flower, lateral sectional view x 2
3. A pistillate flower, lateral sectional view x 2
4. A mature leaf x ½
5. Fruit, lateral view x ½
6. Seed, lateral view x 1
7. Winter twig x ½

LEGUMINOSAE

Gymnocladus dioica (L.) K. Koch [Gymnocladus canadensis Lam.]

Kentucky Coffee Tree

Habit — A large tree, under favorable conditions sometimes attaining a height of 100 feet with a trunk diameter of 2–4 feet, generally much smaller in central and western New York. Trunk usually short, dividing ten or fifteen feet above the ground into several stout, ascending limbs to form a narrow, obovate crown. Under forest conditions the bole may be columnar and free of branches for 70–80 feet.

Leaves — Alternate, bipinnate, 1–3 feet long, 1½–2 feet broad, with 7–13 pinnae and 1–2 basal pairs of lobed leaflets, borne on glabrous, terete, purplish green leaf-stalks which are prominently enlarged at the base. Pinnae consisting of 6–15 leaflets borne subopposite or alternate on the secondary rachis. Leaflets ovate to oval, taper-pointed at the apex, rounded and inequilateral at the base, entire, at maturity dark green and lustrous above, paler beneath, short-stalked, 1–2½ inches long, falling separately in the autumn.

Flowers — Appearing in June after the leaves, regular, greenish white, polygamous, borne in terminal racemes or panicles. Staminate inflorescence 3–4 inches long, the lower branches usually several-flowered. Pistillate inflorescence 10–12 inches long, the flowers fewer and longer-stalked than in the staminate clusters. Calyx about ⅔ of an inch long, narrowly tubular, white-tomentose, 10-ribbed and 5-lobed, the lobes linear-lanceolate. Petals oblong, slightly keeled and inrolled, nearly white, tomentose on the inner surface, longer than the calyx-lobes. Stamens 10, included, inserted on the calyx-tube, with awl-shaped hairy filaments and orange anthers. Pistil consisting of a hairy, linear-lanceolate sessile, ovary, short style and oblique stigma.

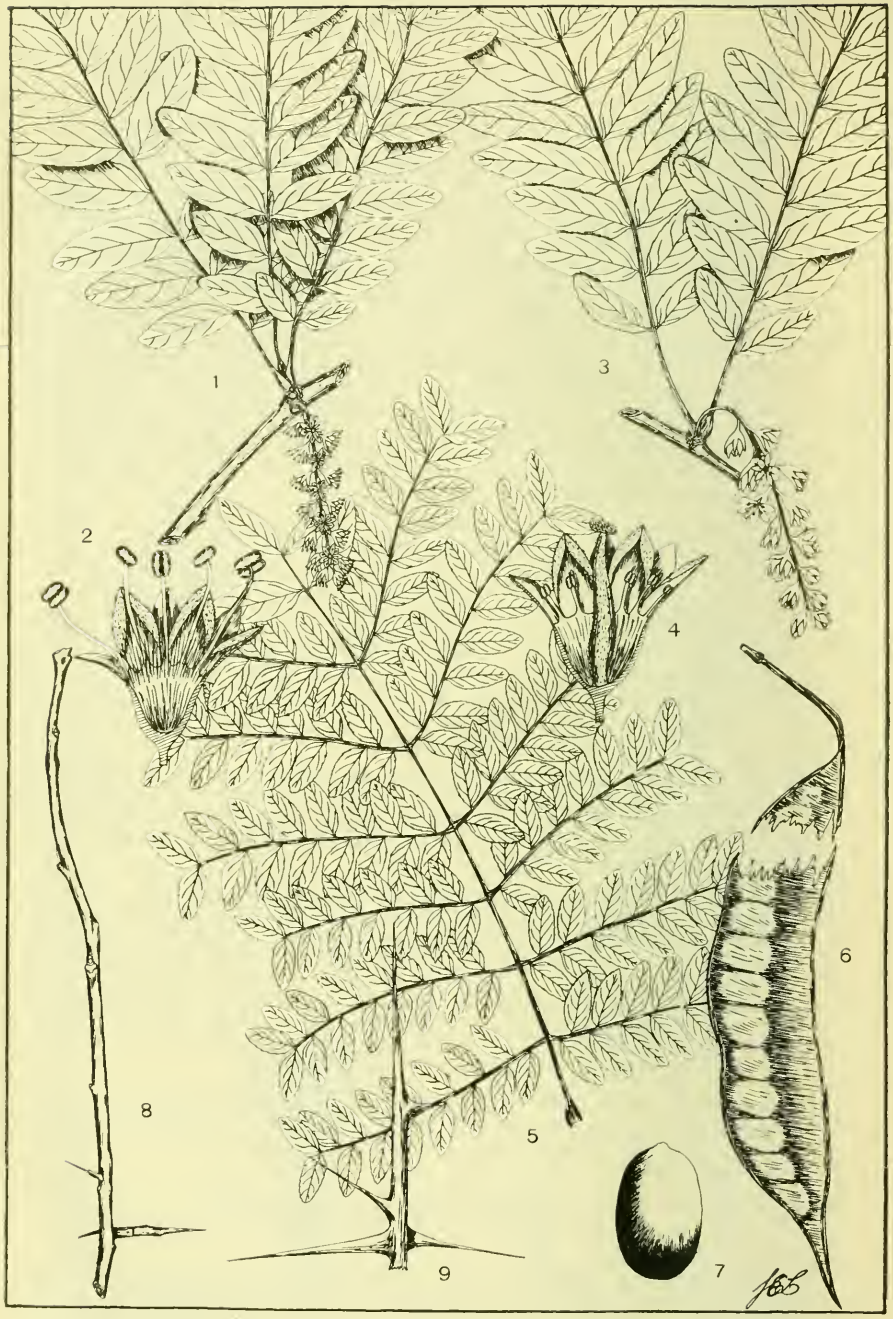
Fruit — A broad, flat, thick, somewhat glaucous, reddish brown, woody legume, 4–10 inches long, 1–2 inches broad, borne on a stout stalk 1–2 inches long, persisting on the trees into the winter. Flesh thick, dark-colored, sweet. Seeds ovate to oval, somewhat compressed, thick-walled, about ¾ of an inch long.

Winter characters — Twigs very stout, blunt-pointed, dark brown or greenish brown and usually with a pale evanescent skin, marked with orange-colored lenticels and broad, heart-shaped leaf-scars. Pith large, salmon-colored. Terminal bud absent. Lateral buds 2 or 3 at a node, small, bronze, silky-pubescent, sunken in the twig so that they scarcely project beyond its surface, surrounded by a hairy, incurved ring of bark. Accessory buds superposed, the upper the larger. Mature bark rather thick, dark grayish brown, divided by shallow fissures into shallow ridges covered with reflexed scales.

Habitat — In the wild state a typical bottom-land species preferring deep, rich, alluvial soils in company with Black Ash, Cottonwood, Honey Locust, etc. Will thrive in drier situations if not overtopped by other species. An intolerant tree.

Range — Central New York westward to southern Minnesota and eastern Nebraska, southwest through Ohio, Kentucky, Tennessee and Oklahoma. Zones A, **B**, and C.

Uses — Of wide distribution but one of the rarest forest trees of eastern United States. Wood rather soft, heavy, coarse-grained, light brown with thin, paler sapwood. Occasionally used for fence posts, railroad ties, in cabinet making and in general construction. Widely planted as an ornamental tree in parks, cemeteries, and gardens because of its striking appearance, particularly during the winter months. The seeds were used by early pioneers as a substitute for coffee, hence the name, "Kentucky Coffee Tree."



Honey Locust

Gleditsia triacanthos L.

1. A twig showing staminate flowers and mature pinnate leaves x ½
2. A staminate flower, lateral sectional view x 3
3. A twig showing pistillate flowers and mature pinnate leaves x ½
4. A pistillate flower, lateral sectional view x 3
5. A bipinnate leaf x ½
6. Fruit, lateral view x ½
7. Seed, lateral view x 2
8. Winter twig x ½
9. Branched thorn x ½

LEGUMINOSAE

Gleditsia triacanthos L.

Honey Locust

Habit — Usually a medium-sized tree 40–80 feet high with a trunk diameter of 1–3 feet, under favorable conditions on rich river bottoms occasionally 140 feet tall. Trunk generally short, characteristically marked with clumps of thorns, dividing a few feet above the ground into a number of stout, ascending limbs and slender, spreading, somewhat pendulous, zigzag branches to form a broadly obovate or flat-topped head.

Leaves — Alternate, pinnate or bipinnate, 6–8 inches long, borne on flattened, pubescent petioles which are grooved above and enlarged at the base. Pinnate leaves with 18–28 nearly sessile leaflets borne subopposite or alternate on a hairy rachis. Leaflets ovate-lanceolate to elliptical, bluntly acute or rounded at the apex, acute and slightly inequilateral at the base, remotely crenulate-serrate, at maturity dark green and lustrous above, dull yellowish green below, 1–2 inches long. Bipinnate leaves with 4–7 pairs of pinnae. Leaflets similar to those of the pinnate leaves but smaller.

Flowers — Appearing in June when the pinnate leaves are nearly full grown, small, greenish, polygamous, borne in lax racemes from the axils of the leaves of the season or of preceding seasons. Staminate racemes often clustered, pubescent, densely-flowered, 2–2½ inches long at maturity. Pistillate racemes slender, few-flowered, usually solitary, 2½–3½ inches long. Calyx campanulate, unequally 5-lobed, the lobes acute and hairy. Petals oval or oblong-oval, erect, longer than the calyx-lobes, the margin inrolled and pubescent. Stamens 10, exserted, inserted on the calyx-tube, with slender filaments and green anthers. Pistil consisting of a linear-lanceolate, white-tomentose, subsessile, 1-celled ovary, a short style, and a terminal capitate stigma.

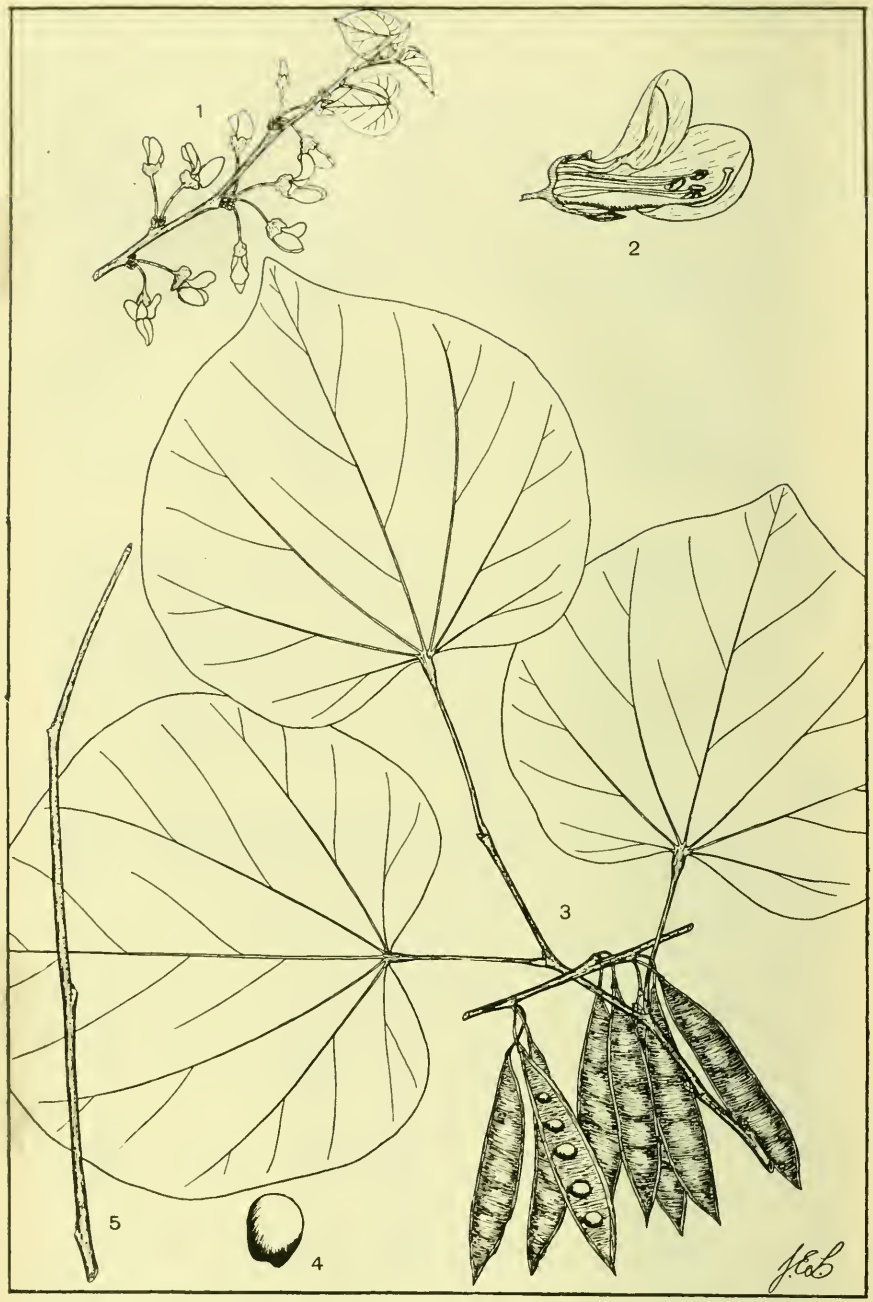
Fruit — A flat, thin, thick-margined, somewhat falcate and twisted, reddish or purplish brown legume, 12–18 inches long, 1–1⅛ inches wide, tapering at either end, borne in clusters of 2 or 3 on short stalks, tardily deciduous during the fall and winter. Flesh thin. Seeds oval, compressed, brown, about ½ of an inch long.

Winter characters — Twigs rather stout, zigzag, thickened at the nodes and apex, lustrous, reddish or greenish brown, at length grayish brown. Simple or branched thorns, often 3–4 inches long, are borne above the leaf-scars and on the trunk and main branches of some trees. Terminal bud absent. Lateral buds minute, several at a node, superposed, the upper larger and scaly, the lower wholly submerged in the bark. Mature bark rather thick, grayish brown to almost black, usually roughened and divided by deep fissures into long, narrow, longitudinal ridges which are scaly on the surface.

Habitat — By preference a bottom-land species attaining its best development in deep, moist soils along stream courses, but occupying a variety of sites in rich woods and on moist mountain slopes. Propagates readily from seeds but requires plenty of light.

Range — Southern Ontario westward to eastern Nebraska and Kansas, southward to Florida and Texas. Zones A, **B**, and C.

Uses — A timber species of secondary value southward beyond the borders of the state. Wood hard, heavy, strong, coarse-grained, very durable in contact with the soil, reddish brown with thin pale sapwood. Used for railroad ties, fence posts and occasionally in construction. This species is widely propagated as a hedge plant because of its vigorous growth and well-armed branches. It is especially free from fungal and insect enemies and is to be recommended as an ornamental tree.



Red Bud, Judas Tree

Cercis canadensis L.

1. A twig showing flowers and immature leaves x ½
2. A flower, lateral sectional view x 2
3. A branch showing mature leaves and fruit x ½
4. Seed, lateral view x 3
5. Winter twig x ½

LEGUMINOSAE

Cercis canadensis L.

Red Bud, Judas Tree

Habit — A large shrub or small tree 20–25 feet in height with a trunk diameter of 5–8 inches, occasionally 45 feet tall with a trunk a foot in diameter. Trunk straight, usually separating 8–10 feet above the ground into a number of stout limbs which are either ascending and form an ovate crown, or wide-spreading, forming a flat, shallow, broad crown.

Leaves — Alternate, broadly ovate, 3–5 inches in diameter, abruptly acute at the apex, cordate or truncate at the base, entire, 5–7-nerved, at maturity medium thick, glabrous, bright green above, paler and glabrous below aside from the tufts of hairs in the axils of the veins, borne on slender petioles which are thickened at either end and 2–5 inches long.

Flowers — Appearing in March and April before the leaves, or as the leaf-buds open, perfect, papilionaceous, about ½ of an inch long, borne on slender pedicels ⅛–½ of an inch long in lateral fascicles of 4–8. Calyx-tube dark purplish red, campanulate, oblique and gibbous at the base, the 5 lobes short and rounded. Petals pink or rose colored, oblong-obovate, rounded at the apex, the upper one the smallest, enclosed by the lateral wing-petals and the basal keel-petals. Stamens 10, separate, shorter than the petals, inserted in 2 rows on the margin of the disk. Pistil short-stalked, inserted obliquely in the bottom of the calyx-tube, consisting of a pubescent 1-celled, many-ovuled ovary, a filiform, upcurved style and capitate stigma.

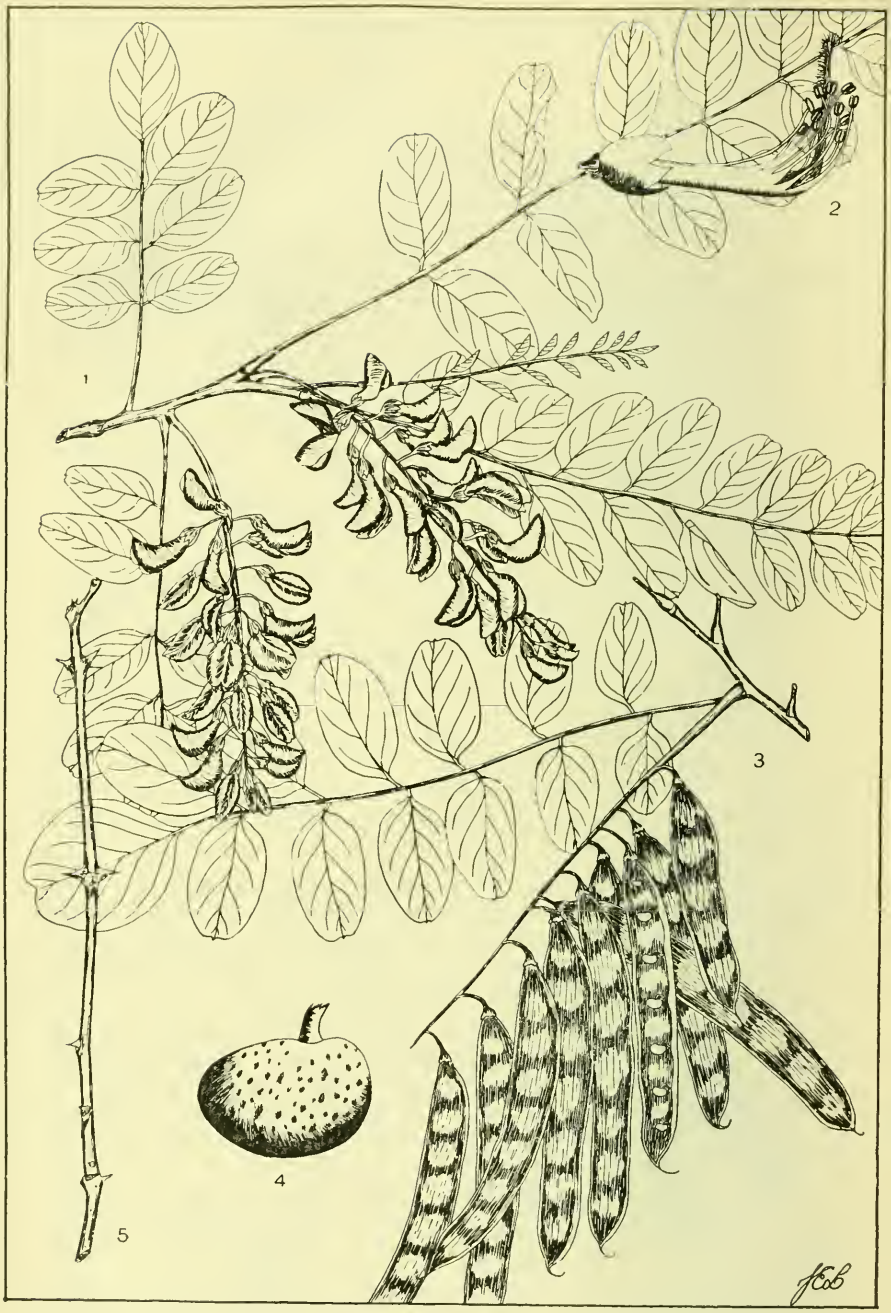
Fruit — A short-stalked, oblong or linear-oblong, compressed legume, 2½–3½ inches long, curved on one side, acute at either end, attaining full size and turning pink or light brown by midsummer but persisting on the trees into the autumn and early winter. Seeds broadly ovate, compressed, thick-walled, chestnut-brown, about ¼ of an inch long.

Winter characters — Twigs slender, zigzag, glabrous and somewhat lustrous, dotted with many small lenticels, light brown, at length grayish brown. Terminal bud absent. Lateral buds blunt, appressed, dark purplish red, about ⅛ of an inch long. One or two accessory, superposed buds often present, the upper one the largest. Mature bark thin, reddish brown to dark brown, shallowly reticulately fissured and scaly.

Habitat — In rich moist soils on bottom-lands, along the borders of streams, on brush lands and in open forest where it often forms a large part of the understory growth.

Range — New Jersey westward through Pennsylvania and southwestern New York to Minnesota, south to Florida and eastern Texas. Zones A and B.

Uses — Of no importance as a timber species because of its small size. Cultivated in this country and abroad for its ornamental value.



Locust, Black Locust, False Acacia

Robinia Pseudo-Acacia L.

1. A flowering branch x ½
2. A flower with corolla removed, lateral view x 2
3. A branch showing mature leaf and fruit x ½
4. Seed, lateral view x 5
5. Winter twig x ½

LEGUMINOSAE

Robinia Pseudo-Acacia L.

Locust, Black Locust, False Acacia

Habit — A medium-seized tree usually 30–60 feet in height with a trunk diameter of ½–2 feet, under optimum conditions sometimes 60–80 feet tall with a trunk 2–4 feet in diameter. In the open the bole is short, dividing a few feet above the ground into a number of stout, ascending branches which form a narrow, oblong, open crown. The trunk of forest grown specimens is often free of branches for three-fourths of its length.

Laeves — Alternate, odd-pinnately compound, 8–14 inches long, consisting of 7–19 subopposite or alternate leaflets arranged along a slender, puberulous rachis which is grooved above and swollen at the base. Leaflets ovate-oblong to elliptical, 1½–2 inches long, mucronate or retuse at the apex, rounded at the base, entire, at maturity dull, dark blue-green and glabrous above, paler and glabrous below except on the midrib, borne on stout petioles ⅛–¼ of an inch long, turning yellow and falling early in the autumn.

Flowers — Appearing in late May or early June when the leaves are nearly grown, perfect, irregular, white, fragrant, about 1 inch long, borne on slender, reddish pedicels in drooping, puberulous racemes 4–5 inches long. Calyx campanulate, gibbous on the upper side, reddish green and pilose, persistent, 5-lobed, the lower lobe longer than the others, corolla resembling that of a sweet pea, consisting of a broad, obcordate, reflexed standard (one petal), marked on the inner surface with a yellow spot, two oblong falcate wings (one petal each), and acurved keel (two petals united below). Stamens 10, diadelphous, the upper free, the remainder united into a cylinder which is cleft on the upper side and encloses the style. Pistil consisting of a linear-oblong, stipitate ovary, a geniculate, subulate style bearded toward the top on the inner side, and a small terminal stigma.

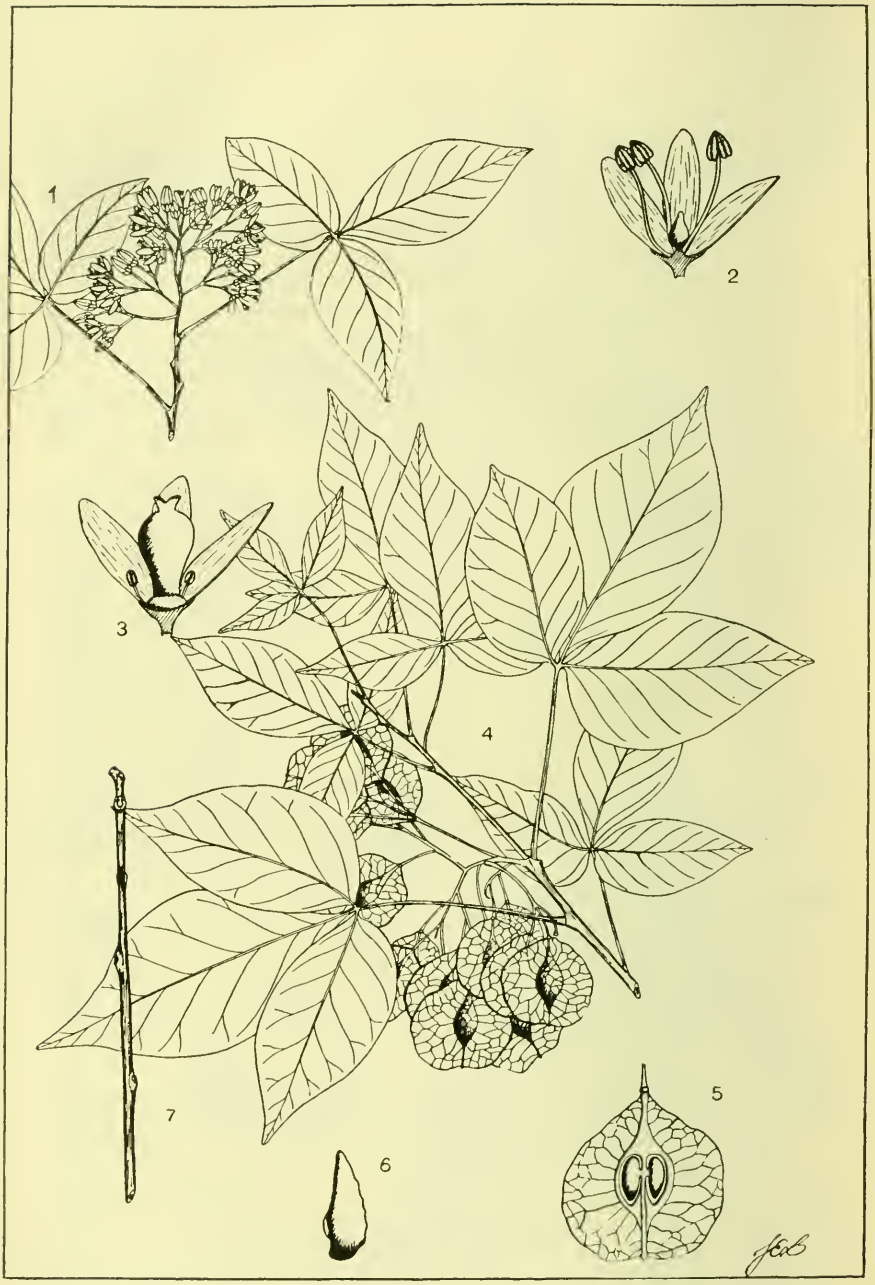
Fruit — A flat, oblong-linear, somewhat falcate, glabrous, reddish brown legume, 2–4 inches long, ½ of an inch wide, borne on stout, thick-stemmed racemes, early dehiscent but persisting on the trees into the winter. Seed reniform, compressed, orange-brown with darker mottling, about 3/16 of an inch long, borne on a curved funiculus, 4–8 to a pod.

Winter characters — Twigs slender or rather stout on vigorous growth, brittle, more or less zigzag, terete or angular in cross section, glabrous, light reddish to greenish brown. Divergent or slightly recurved stipular-thorns present on vigorous growth. Terminal bud absent. Lateral buds small, 3–4 at a node, superposed, imbedded in the twig under the leaf-scar, at length erumpent. Mature bark thick, reddish or yellowish brown, deeply furrowed into rounded ridges covered with squarish persistent scales.

Habitat — Moist, fertile mountain slopes and along stream courses in rocky, gravelly or alluvial soils. Widely naturalized in eastern United States, occurring about dwellings, along highways and in waste places as a "weed" tree, spreading by means of root-suckers and often forming extensive thickets.

Range — Originally confined to the slopes of the Appalachian Mountains from Pennsylvania to Georgia. Now widely naturalized in the United States east of the Rocky Mountains. Zones A, **B**, and C.

Uses — A valuable timber species, easily propagated by cuttings and of rapid growth, but in certain sections subject unfortunately to the attacks of several serious pests including the Locust Borer. Wood very hard, heavy, strong, very durable, brown or greenish yellow with narrow, pale yellow sapwood. Used for fence posts, insulator pins, tree nails, railroad ties, in shipbuilding and for other purposes where strength, freedom from checking, and durability in contact with the soil are requisite. Widely planted both at home and abroad for timber and ornament.



Hop Tree, Wafer Ash

Ptelea trifoliata L.

1. A twig showing inflorescence and immature leaves x ½
2. A staminate flower, lateral sectional view x 3
3. A pistillate flower, lateral sectional view x 3
4. A branch showing mature leaves and fruit x ½
5. Fruit, lateral surface view x 1
6. Seed, sectional view x 3
7. Winter twig x ½

RUTACEAE

Ptelea trifoliata L.

Hop Tree, Wafer Ash

Habit — A shrub or small tree 20–25 feet in height with a trunk diameter of 6-12 inches. Trunk straight, slender, bearing a broad, rounded crown of many slender twigs.

Leaves — Alternate or rarely opposite, compound, 4–6 inches long, 2½–3 inches wide, consisting of 3 nearly sessile leaflets borne at the top of a stout petiole which is thickened at the base and 2½–3 inches in length. Leaflets ovate or oblong, acute at the apex, cuneate at the base, entirely or remotely crenulate, the terminal usually larger and more contracted at the base than the others, at maturity subcoriaceous, dark green and lustrous above, paler and smooth or pubescent beneath.

Flowers — Appearing in June after the leaves, greenish white, polygamous, borne intermixed on slender pedicels in terminal, often compound cymes. Calyx 4–5-parted, with ovate, acute lobes. Petals 4–5 hypogynous, longer than the sepals. Stamens 4–5, alternate, exserted in the staminate flowers, much smaller or abortive in the pistillate flower. Pistil consisting of an oblong, compressed, puberulent ovary surmounted by a short style and 2–3-lobed stigma.

Fruit — A 2-celled, 2-seeded, orbicular, compressed, buff-colored samara surrounded by a broad, reticulate wing. Fruits ripen in the late autumn and are borne on long, slender, reflexed pedicels which persist on the twigs during the winter.

Winter characters — Twigs slender, yellowish brown, lustrous, conspicuously marked by leaf-scars, with a rank odor when broken. Terminal bud absent. Lateral buds small, whitish-hairy, rotund, mostly superposed, borne in the upper angle of V-shaped leaf-scars. Mature bark thin, smooth, dark gray, with numerous, oblong, wart-like excrescences.

Habitat — On rocky, upland slopes about the borders of forests and woods.

Range — Central New York westward through southern Ontario to Minnesota, southward to Florida and Texas. Zones A and B.

Uses — Occasionally propagated as an ornamental plant in the parks and gardens of eastern United States. The bitter principle obtained from the roots is sometimes used as a tonic.

Ailanthus, Chinese Sumach, Tree of Heaven

Ailanthus glandulosa Desf.

1. A staminate inflorescence x ½
2. A staminate flower, lateral sectional view x 10
3. Portion of a pistillate inflorescence x ½
4. A pistillate flower with one petal removed, lateral view x 10
5. A mature leaf x ½
6. A cluster of samaras x ½
7. Winter twig x ½

SIMAROUBACEAE

Ailanthus glandulosa Desf.

Ailanthus, Chinese Sumach, Tree of Heaven

Habit — In New York State usually a medium-sized tree 30–40 feet in height with a trunk diameter of ¾–2 feet, occasionally where conditions are favorable 100 feet tall with a trunk 3 feet in diameter. Bole usually short, dividing 6–10 feet above the ground into a few, stout, ascending limbs to form a wide, flat-topped crown of sparse, coarse branches.

Leaves — Alternate, odd-pinnately compound, 1–3 feet long, consisting of 13–41 short-stalked, subopposite or alternate leaflets arranged along a long, tapering, smooth rachis. Leaflets ovate-lanceolate, 3–5 inches long, acuminate at the apex, truncate or cordate and somewhat inequilateral at the base, entire except for a few coarse teeth toward the base, at maturity thin, light green and glabrous above, paler, pubescent and often glandular on the basal lobes beneath.

Flowers — Appearing during June after the leaves are fully developed, polygamous, greenish white, about ¼ of an inch broad, borne in terminal panicles, the staminate often a foot in length, densely-flowered and ill-scented, the pistillate smaller and fewer flowered. Calyx 5-lobed, the lobes broadly ovate, acute. Petals 5, oval, acute, valvate, inrolled, much longer than the sepals. Stamens 10 in the staminate flowers, inserted with the petals on the edge of the disk, exserted, the filaments hairy toward the base. Perfect flowers with 2–3 stamens. Pistil consisting of a deeply 2–5-lobed ovary surmounted by an equal number of short styles and spreading stigmas.

Fruit — A flat, veiny, oblong-linear, glabrous, twisted, pale yellow samara, 1½–2 inches long, about ½ of an inch wide, rounded at the apex, tapering at the base, notched on one side and bearing the solitary seed near the middle, borne in ample clusters on short stalks, persisting on the tree into the winter and following spring.

Winter characters — Twigs very stout, blunt-pointed, yellowish to reddish brown, glabrous or fine velvety-pubescent, marked with scattered, ochre lenticels, ill-smelling when crushed. Pith large, ochraceous. Terminal bud absent. Lateral buds hemi-spherical, reddish brown, pubescent, ⅛–⅙ of an inch long, usually with but 2 visible scales, located in a notch above the large leaf-scar. Mature bark thin, dark gray, slightly roughened by shallow, whitened fissures.

Habitat — A "weed" tree growing vigorously on a variety of sites in vacant lots, about cities, and along streets and highways where less resistant species cannot compete, owing to adverse conditions.

Range — A native of China, introduced into this country for ornamental purposes and now widely naturalized as a "weed" tree in the northeastern states and Ontario. Zones A, B, and C.

Uses — Undesirable either as a lumber tree or for ornament. Wood soft, weak, coarse-grained, not durable. Objectionable as a shade or park tree because difficult to eliminate when once established, owing to root-suckers. The staminate trees should never be propagated because of the disagreeable odor of the flowers. It recommends itself only as a shade tree where urban conditions are too rigorous for other species.

Staghorn Sumach

Rhus typhina L. [Rhus hirta (L.) Sudw.; Datisca hirta L.]

1. A staminate inflorescence x ½
2. A staminate flower, lateral sectional view x 10
3. A pistillate flower with two petals removed, lateral view x 10
4. A mature leaf x ½
5. Fruit cluster x ½
6. Hairy drupe x 3
7. Pit, lateral view x 3
8. Winter twig x ½

ANACARDIACEAE

Rhus typhina L. [Rhus hirta (L.) Sudw.; Datisca hirta L.]

Staghorn Sumach

Habit — A small tree 25–30 feet in height with a trunk diameter of 4–8 inches, occasionally 40 feet tall with a trunk a foot in diameter, more often shrubby, spreading by means of underground shoots and forming extensive thickets. In the aborescent form, the bole is short and often inclined, and bears a low flat crown consisting of stout, ascending, more or less contorted, irregular branches.

Leaves — Alternate, odd-pinnately compound, 1½–2 feet long, consisting of 11–31 nearly sessile leaflets arranged in pairs along a stout, hairy, reddened rachis. Leaflets oblong, 2–5 inches long, acute at the apex, rounded or slightly cordate at the base, remotely and sharply serrate, at maturity dull dark green and quite glabrous above, paler and glabrous below aside from the midrib.

Flowers — Appearing in June or July after the leaves, dioecious (by abortion), yellowish green, borne on slender, bracteolate pedicels in dense, terminal panicles 5–12 inches long, the staminate the larger and more open. Calyx 5-lobed, the lobes lanceolate, acute, woolly without, longest in the pistillate flower. Petals 5, strap-shaped, yellowish green and reflexed at anthesis in the staminate flower, green, narrower, thickened at the apex and erect in the pistillate flower. Stamens 5, inserted on the margin of the red disk, exserted, the anthers bright orange. Pistil consisting of an ovoid, pubescent ovary, 3 short, spreading styles and a similar number of capitate stigmas.

Fruit — A depressed-globular or hemi-spherical drupe, about ⅛ of an inch in diameter, densely covered with crimson acid hairs, borne in dense panicles which persist throughout the winter. Pit somewhat reniform, orange-brown, smooth.

Winter characters — Twigs very stout, densely pubescent with olive-brown to nearly black hairs, exuding a milky juice when broken, usually winter-killing through several nodes. Lenticels orange-colored and conspicuous. Pith large, orange-colored, homogeneous. Terminal bud absent. Lateral buds conical, obtuse, protected by a dense, pale brown tomentum, nearly surrounded by the leaf-scar. Mature bark dark brown, dotted with horizontally elongated lenticels, occasionally with small, superficial scales.

Habitat — A "weed" tree found on a variety of soils and sites along fences and highways, in pastures, and on talus slopes and cliffs, usually in dry situations, often forming copses of wide extent.

Range — New Brunswick westward through southern Canada to Minnesota, south to Georgia and Alabama. Zones A, **B**, and C.

Uses — Of little commercial value. Wood light, soft, golden yellow tinged with green, with paler sapwood. Occasionally used for picture frames and nicknacks. This species is sometimes propagated ornamentally because of its showy autumal foliage and fruits, and grotesque habit. Several horticultural varieties have been evolved.

Smooth Sumach

Rhus glabra L.

1. A staminate inflorescence x ½
2. A staminate flower, lateral sectional view x 10
3. A pistillate flower with two petals removed, lateral view x 10
4. A mature leaf x ½
5. Fruit cluster x ½
6. Drupe, lateral view x 5
7. Pit, lateral view x 5
8. Winter twig x ½

ANACARDIACEAE

Rhus glabra L.

Smooth Sumach

Habit — Usually a low, spreading shrub, propagating by means of root-suckers and often forming extensive thickets, occasionally becoming a small tree 20–25 feet in height with a short trunk 4–5 inches in diameter which divides 3–4 feet above the ground into a number of stout, ascending branches to form a broad, flat-topped crown.

Leaves — Alternate, odd-pinnately compound, 1–3 feet long, consisting of 11–31 nearly sessile leaflets arranged subopposite ly or alternately along a smooth, stout, reddish rachis. Leaflets lanceolate-oblong, 2–5 inches long, acute at the apex, rounded and somewhat inequilateral at the base, sharply and remotely serrate, at maturity dark green and glabrous above, pale glaucous beneath.

Flowers — Appearing in June or July after the leaves, dioecious, yellowish green, borne in terminal panicles 5–12 inches long, the staminate panicles more open and larger than the pistillate. Calyx 5-lobed, the lobes ovate-lanceolate, acute, somewhat pubescent without, longest in the pistillate flowers. Petals ovate, acute, yellowish green. Stamens 5, inserted on the margin of the conspicuous disk, shorter than the petals. Pistil consisting of an ovoid, pubescent ovary surmounted by 3 short styles and capitate stigmas.

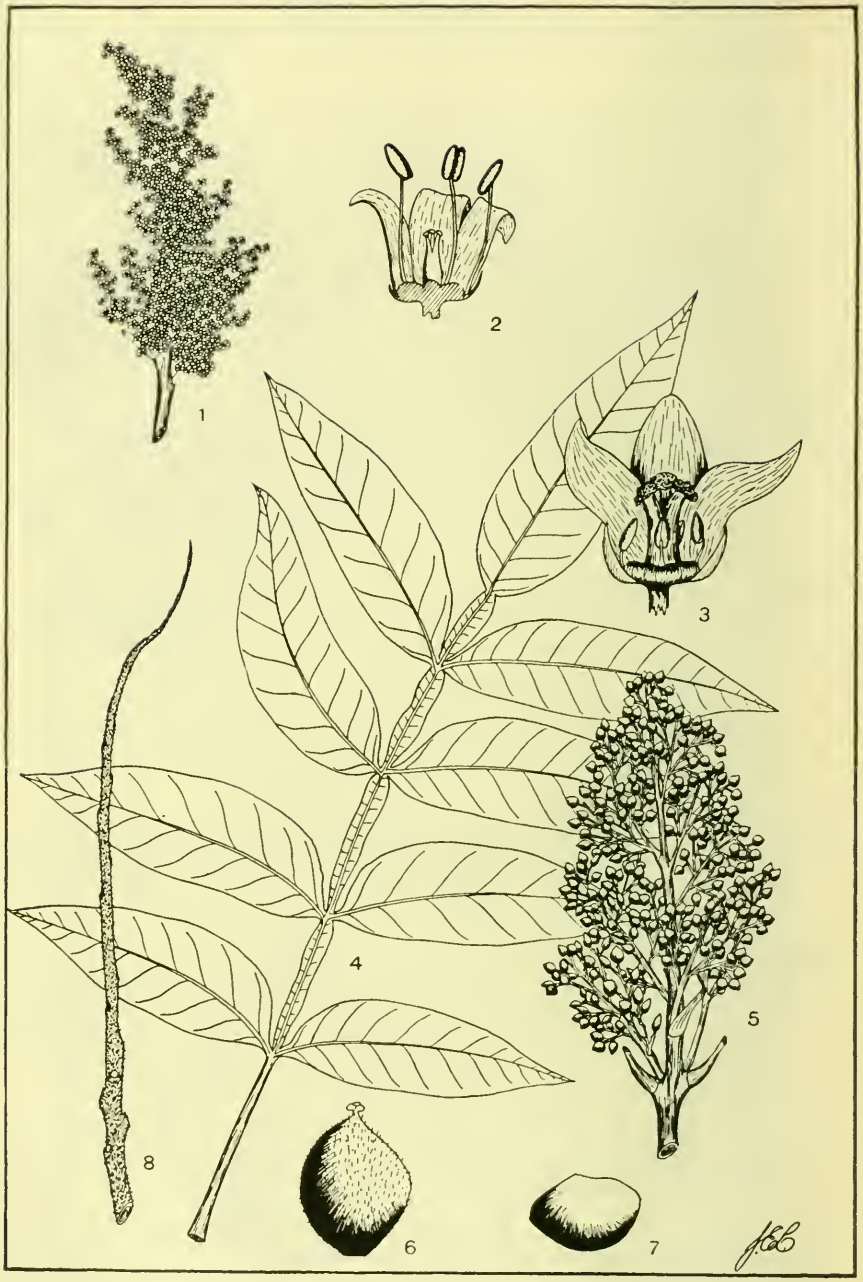
Fruit — A depressed-globular, crimson drupe, about ¼ of an inch in diameter, covered with short, close, acidulous pubescence, borne in rather open, narrow panicles, persisting on the tree into the winter and following spring. Pit ovoid, orange-brown, smooth.

Winter characters — Twigs very stout, lenticellate, pale bronze, usually glaucous and in part covered with a grayish, evanescent skin exuding a milky juice when broken, usually winter-killing through several nodes. Pith large, orange-colored, homogeneous. Terminal bud absent. Lateral bud conical, obtuse, densely covered with pale brown tomentum, nearly surrounded by the leaf-scar. Mature bark thin, gray, quite smooth.

Habitat — On a variety of sites and soils in open pastures, on hillsides and on waste ground, seeming to prefer well-drained situations, often forming thickets of considerable extent.

Range — Nova Scotia westward through Ontario to Minnesota, south to Florida and Louisiana. Zones **A**, **B**, and C.

Uses — The importance of this species lies in its use as an ornamental shrub. In New York State it is numbered among the best for mass planting. A cut-leaved form, var. laciniata, is widely propagated for the same purpose.



Dwarf Sumach

Rhus copallina L.

1. A staminate inflorescence x ½
2. A staminate flower, lateral sectional view x 10
3. A pistillate flower with two petals removed, lateral view x 10
4. A mature leaf x ½
5. Fruit cluster x ½
6. Pubescent drupe, lateral view x 5
7. Pit, lateral view x 5
8. Winter twig x ½

ANACARDIACEAE

Rhus copallina L.

Dwarf Sumach

Habit — In the north usually a shrub 5–8 feet tall, spreading by means of root-suckers, and often forming extensive copses in pastures and abandoned fields, occasionally a small tree 20–30 feet in height with a short, usually oblique trunk 8–10 inches in diameter bearing a wide-spreading crown of stout branches.

Leaves — Alternate, odd-pinnately compound, 6–12 inches long, consisting of 9–21 sessile or nearly sessile leaflets arranged in pairs along a winged rachis. Leaflets oblong to ovate-lanceolate, 1½–2½ inches long, acute at the apex, cuneate and usually inequilateral at the base, entire or remotely serrulate above the middle, at maturity thick, dark lustrous green and glabrous above except on the midrib, paler and pubescent below.

Flowers — Appearing in late June or July after the leaves are full grown, dioecious, yellowish green, borne in short, compact, pubescent, terminal or axillary panicles 4–6 inches long, the staminate panicles usually the larger. Calyx 5-lobed, the lobes ovate, acute, puberulous on the inner surface. Petals ovate, acute, greenish yellow, at anthesis reflexed above the middle. Disk red, conspicuous. Stamens 5, exserted, with slender filaments and orange-colored anthers. Pistil consisting of an ovate, pubescent ovary surmounted by 3 stout, spreading styles terminated by capitate stigmas. Vestigial organs occur in flowers of both sexes.

Fruit — An oval or slightly ovate, somewhat compressed, thin-fleshed, bright red drupe about ⅛ of an inch in diameter, covered with close, glandular pubescence, borne in stout, pubescent clusters, ripening in the early autumn but persisting on the trees into the winter and following spring. Pit somewhat reniform, orange-brown, smooth.

Winter characters — Twigs medium stout, tapering and somewhat zigzag, pubescent, reddish brown with prominent leaf-scars and conspicuous lenticels, exuding a watery juice when broken, usually winter-killing through several nodes. Terminal bud absent. Lateral buds small, spherical, covered with rusty brown hairs, superposed above the leaf-scar. Mature bark thin, pale reddish brown, dotted with horizontal elongated lenticels, exfoliating tardily in large, papery scales.

Habitat — Dry sandy soils on hillsides, ridges, and in abandoned fields and pastures, often forming extensive thickets, more rarely on rich bottom lands.

Range — Central Maine westward through southern Ontario and Michigan to eastern Nebraska, southward to Florida and Texas.

Uses — Not a timber species because of its small size. Widely used as an ornamental shrub in the parks and cemeteries of eastern United States and prized for its dark green, lustrous leaves which turn a rich maroon in the autumn, for its small stature, and persisting, showy fruit-clusters.

Poison Sumach

Rhus Vernix L. [Toxicodendron Vernix (L.) Shafer; Rhus venenata DC.]

1. A pistillate inflorescence x 1
2. A staminate flower, lateral sectional view x 10
3. A pistillate flower, lateral sectional view x 10
4. A mature leaf x ½
5. Fruit cluster x 2½
6. Drupe, lateral view x 2½
7. Pit, lateral view x ½
8. Winter twig x ½

ANACARDIACEAE

Rhus Vernix L. [Toxicodendron Vernix (L.) Shafer; Rhus veneuata DC.]

Poison Sumach

Habit — A shrub or small tree 20–25 feet in height with a trunk 5–6 inches in diameter which generally divides near the ground into a number of stout, spreading limbs to form an open, rounded, bushy crown of coarse branches.

Leaves — Alternate, odd-pinnately compound, 7–14 inches long, consisting of 7–13 leaflets arranged suboppositely along a smooth, greenish red rachis. Leaflets obovate-oblong, 3–4 inches long, acute at the apex, cuneate and inequilateral at the base, entire, revolute margined, short-petiolate aside from the terminal leaflet, at maturity coriaceous, dark green and lustrous above with scarlet midribs, paler and glabrous below.

Flowers — Appearing in June and July before the leaves have attained full size, dioecious, yellowish green, borne in rather narrow, drooping, axillary panicles 2½–8 inches long clustered near the tips of the twigs. Calyx 5-lobed, ovate, acute, glabrous. Disk prominent. Petals ovate-lanceolate, acute, erect. Stamens 5, exserted, with slender filaments and orange-colored anthers. Pistil consisting of an ovoid-globose, glabrous ovary surmounted by 3 short, thick, spreading styles terminated by proximate, capitate stigmas. Vestigial organs occur in flowers of both sexes.

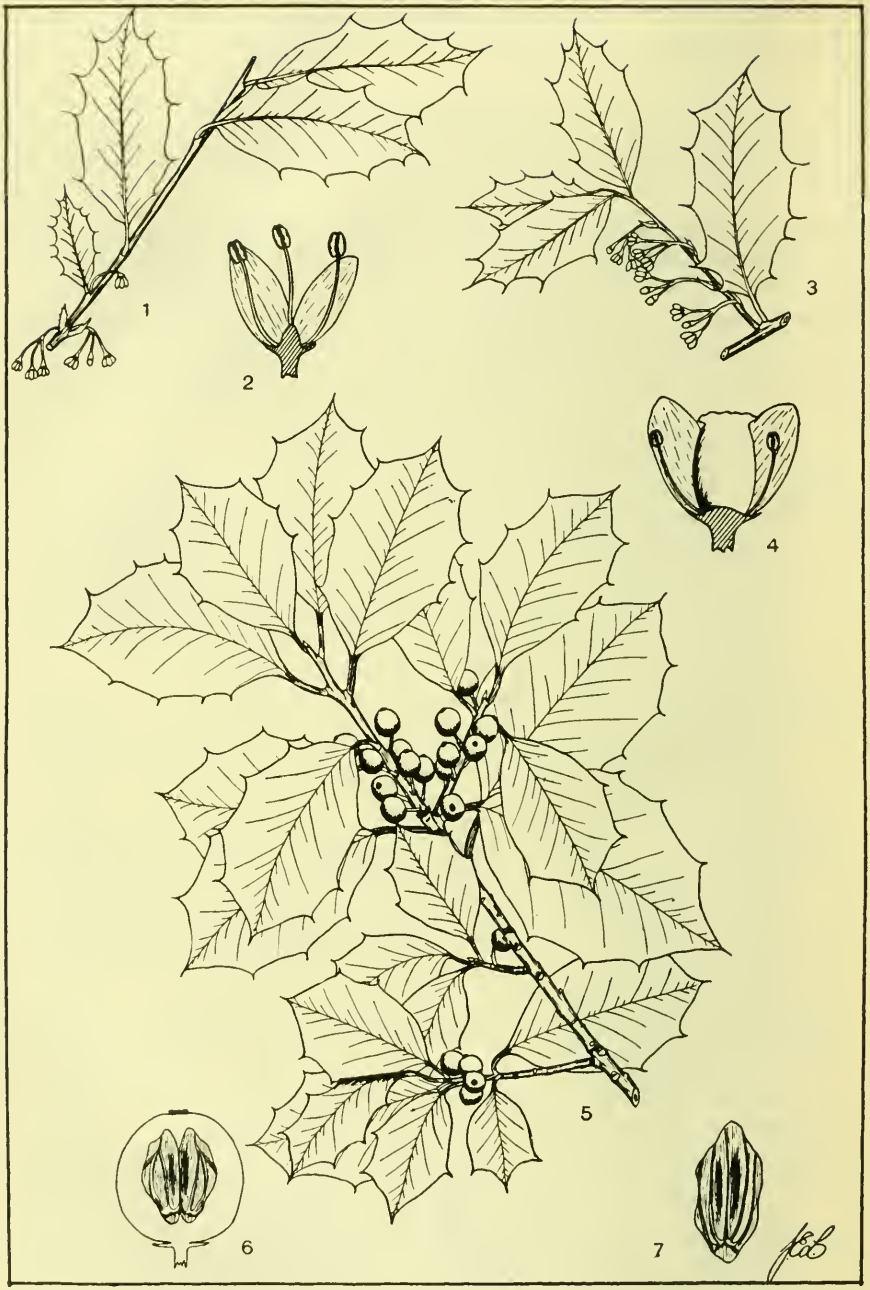
Fruit — A globose, slightly compressed, thin-fleshed, lustrous, ivory-white or tawny white, somewhat striated drupe, tipped with the style remnants, about ⅛ of an inch in diameter, borne in loose, pendant clusters, ripening in September but persisting on the trees far into the winter. Pit pale yellow, thin-shelled, prominently grooved.

Winter characters — Twigs stout, glabrous, brown to orange-brown, marked by numerous, minute, raised lenticels, exuding a watery, poisonous juice when broken, at length light gray. Pith large, yellowish brown, homogeneous. Terminal bud conical, acute, purplish, finely pubescent, ⅕–⅗ of an inch long. Lateral buds similar but much smaller. Mature bark thin, pale light gray, smooth or somewhat striate, marked with prominent, horizontally elongated lenticels.

Habitat — In old peat bogs and cold, wet swamps which are often inundated for a portion of the year.

Range — Northern New England westward through southern Ontario to Minnesota, southward into the Gulf States. Zones **A**, **B**, and C.

Uses — A poisonous species to be shunned by people susceptible to its poisonous properties. The active principle is a non-volatile oil similar to and causing the same reaction as that from Poison Ivy. The symptoms are acute irritation of the skin including itching, swelling and the formation of blisters which exude a hyaline, somewhat viscid fluid when ruptured. It is recommended that the parts be scrubbed vigorously with alcohol or a saturated solution of lead acetate as soon after exposure as possible. In lieu of this, use soap and water. More advanced stages may be relieved with an aqueous solution of baking soda, applied directly to the affected parts. The species has no economic value.



Holly

Ilex opaca Ait.

1. A twig showing staminate flowers x ½
2. A staminate flower, lateral sectional view x 4
3. A twig showing pistillate flowers x ½
4. A pistillate flower, lateral sectional view x 4
5. A branch with mature leaves and fruit x ½
6. Fruit in lateral sectional view x 2
7. Ribbed nutlet x 3

AQUIFOLIACEAE

Ilex opaca Ait.

Holly

Habit — A small tree 20–30 feet in height with a trunk diameter of 6–18 inches, under favorable conditions sometimes 50 feet tall with a trunk 3 feet in diameter. Bole continuous through the crown. Crown compact, conical, consisting of slender, spreading, horizontal or somewhat drooping branches bearing evergreen leaves, often extending nearly to the ground.

Leaves — Alternate, elliptical to obovate-oblong, 2–4 inches long, pungently acute at the apex, broadly cuneate at the base, sinuate with rather distant spiny teeth or entire, at maturity coriaceous, dull dark green, glabrous and centrally grooved above, paler and smooth beneath, borne on short, stout, thickened petioles.

Flowers — Appearing in late May and June in New York State, small, dioecious, axillary on slender, puberulous, bracteolate pedicels, the staminate in 3–9-flowered cymes, the pistillate singly or 2–3 together. Calyx minute, 4–6-lobed, the lobes triangular, acute, ciliate, persistent. Petals 4–6, oblong, obtuse, greenish white, about ⅛ of an inch long. Stamens 4–6, alternate with the petals, exserted, with subulate filaments and oblong anthers. Pistil consisting of a sessile, subcylindrical, 4–6-celled ovary and sessile, usually confluent stigmas which persist in fruit.

Fruit — A spherical or ovoid, glabrous, dull red or occasionally yellow drupe, about ¼ of an inch in diameter, subtended by the persistent calyx, usually borne solitary on short, stout stalks, ripening in the autumn but remaining on the branches until the following spring. Nutlets light brown, prominently few-ribbed on the back.

Winter characters — Leaves persisting on the twig about three years, turning yellowish green during the winter months. Twigs rather stout, glabrous, pale brown, with inconspicuous lenticels. Buds short, the terminal acute, the lateral obtuse and somewhat downy. Mature bark grayish white, roughened by warty excrescences, about ½ of an inch thick.

Habitat — Prefers moist sites on the borders of swamps and on rich bottomlands but thrives on drier soils in protected situations. Along the coast it is frequently found growing behind the protecting sand dunes.

Range — Coastal region from Maine to Florida and eastern Texas, extending north in the Mississippi basin to southern Illinois and Indiana. It is exceedingly rare at higher elevations in the interior. Zone A.

Uses — The sprays of evergreen leaves and bright berries (drupes) are used in immense quantities for holiday decoration. The tree possesses ornamental value but is not used extensively for this purpose because of its slow growth. Wood light, tough, rather weak, close-grained, ivory-white when first cut, turning brown with exposure. Used for umbrella handles, for turnery of all sorts, and in the manufacture of souvenirs and nicknacks.

Striped Maple, Moosewood

Acer pennsylvanicum L.

1. A flowering branch x ½
2. A staminate flower, lateral sectional view x 10
3. A pistillate flower, lateral sectional view x 10
4. A fruiting branch x ½
5. Winter twig x ½

ACERACEAE

Acer pennsylvanicum L.

Striped Maple, Moosewood

Habit — Usually a large shrub or small tree 10–25 feet in height with a trunk diameter of 2–6 inches, occasionally 30–40 feet in height with a trunk 8–10 inches in diameter. Trunk usually short, dividing a few feet above the ground into slender, straight, ascending branches which form a deep, broad crown, often several stems together.

Leaves — Opposite, broadly obovate to orbicular, 4–6 inches long, 4–5 inches wide, cordate or rounded at the base, palmately 3-nerved and acutely 3-lobed at the apex and occasionally with 2 short additional lobes at the base, sharply and finely doubly serrate, at maturity membranous, pale green and glabrous above, paler and nearly smooth beneath, borne on stout, grooved petioles which are enlarged at the base and 1½–2 inches long.

Flowers — Appearing in May and June when the leaves are nearly full grown, dioecious or occasionally the two sorts on the same plant, yellowish green, borne in terminal, drooping, stalked racemes 4–6 inches long. Sepals linear-lanceolate, yellowish green, about ¼ of an inch long. Petals obovate to spatulate, bright yellow, slightly longer than the sepals. Stamens 7–8, shorter than the petals, with slender filaments and oval anthers. Pistil consisting of a sessile, broadly obovate, laterally compressed, purplish brown, puberulous ovary surmounted by a stout style and 2 spreading recurved stigmas. Vestigial organs present in both types of flowers.

Fruit — A double samara consisting of two dark reddish brown, 1-seeded, laterally-compressed and somewhat rugose, nut-like carpels each about ¼ of an inch long and bearing on its back a thin, oblong to obovate, divergent wing about ¾ of an inch long. Fruiting racemes glabrous, drooping, 4–6 inches long.

Winter characters — Twigs stout, glabrous, reddish brown, with scattered, inconspicuous lenticels and brown pith. Buds opposite, obtuse, somewhat 4-sided, appressed, short-stalked about ⅜ of an inch long, entirely covered by single pair of red, smooth, valvate scales. Terminal bud larger than the appressed lateral buds. Mature bark thin, quite smooth, green or reddish brown, conspicuously marked longitudinally by white streaks, at length becoming dark gray and rougher.

Habitat — A retiring, tolerant species. Shaded situations in cool, moist woods, deep glens, and on northern exposures where it is protected from excessive isolation. Forms the bulk of the shrubby undergrowth in many places.

Range — Nova Scotia westward through southern Canada and the northern border states to Minnesota, southward along the Applachians to northern Georgia and eastern Tennessee. Zones B, **C**, **D**, and E.

Uses — Of no economic importance. The tree possesses ornamental value and is occasionally grown in the larger parks of the northeastern states but its exacting site requirements preclude its extensive use.

Mountain Maple

Acer spicatum Lam.

1. A flowering branch x ½
2. A staminate flower, lateral sectional view x 5
3. A pistillate flower, lateral sectional view x 5
4. A fruiting branch x ½
5. Winter twig x ½

ACERACEAE

Acer spicatum Lam.

Mountain Maple

Habit — Occasionally a small bushy tree 20–35 feet in height with a trunk diameter of 4–8 inches, more often a shrub growing in clumps of a half dozen or more, or forming extensive thickets.

Leaves — Opposite, broadly ovate to orbicular, 3–5 inches long, cordate at the base, palmately 3-lobed or obscurely 5-lobed, the lobes acute or acuminate at the apex and coarsely crenate-serrate with gland-tipped teeth. At maturity the leaves are membranous, prominently 3-nerved with conspicuous veinlets, glabrous above, dense hoary pubescent below, borne on slender petioles 2–3 inches long which are enlarged at the base and usually turn scarlet during the summer.

Flowers — Appearing in June when the leaves are nearly full grown, polygamo-dioecious, greenish yellow, borne in narrow, erect, terminal, pubescent, long-stalked, compound racemes, the fertile flowers towards the base. Calyx usually 5-lobed, the lobes narrowly obovate, pubescent on the outer surface. Petals usually 5, linear-spatulate, acute, longer than the sepals. Stamens 7–8, free, with slender, glabrous filaments and oblong, glandular anthers, exserted in the staminate flower. Pistil consisting of a sessile, broadly obovate, laterally compressed, pale tomentose ovary surmounted by a columnar style and 2 short, spreading stigmas.

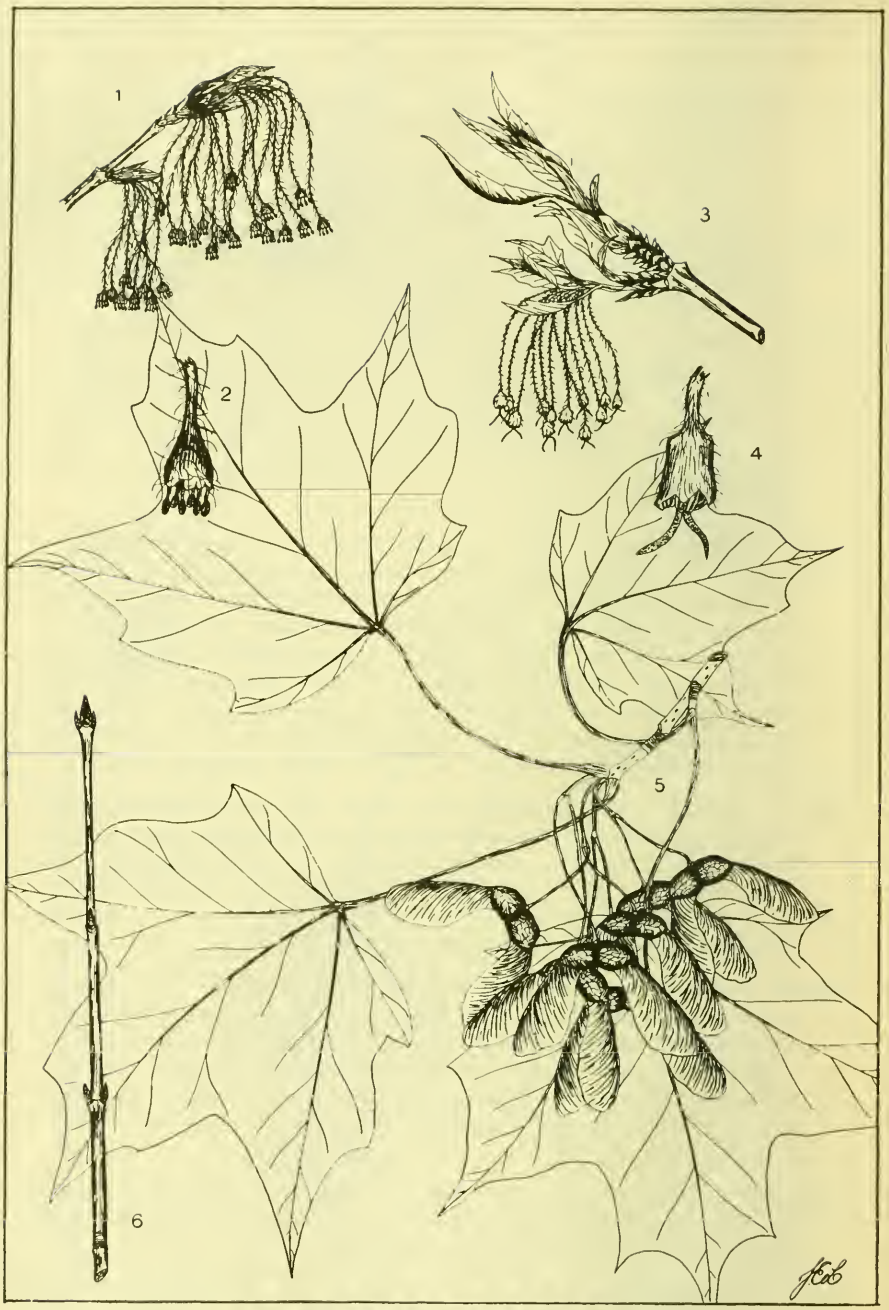
Fruit — A double samara consisting of 2 bright red, 1-seeded, laterally compressed, nearly glabrous, strongly striated, nut-like carpels which develop from the back oblong or obovate, coriaceous, divergent wings about ½ of an inch long. The samaras are borne in drooping, racemose clusters. As they mature in September, the nut-like carpels turn brown and fall separately from the persisting axis.

Winter characters — Twigs slender, bright red, appressed grayish-pubescent at least toward the tip, at length pale grayish brown, often streaked with green toward the base. Buds opposite, acute, appressed, short-stalked, greenish red, about ¼ of an inch long including the stalk. Terminal bud larger. Bud-scales 2–3 pairs, but one or two pairs visible, the inner pair tomentose. Mature bark thin, reddish brown, smooth or slightly furrowed.

Habitat — A retiring species preferring moist sites in rocky glens, gulfs and on talus slopes with northern exposure. Frequent on the moist alpine slopes of the southern Appalachian Mountains.

Range — Newfoundland westward to Manitoba and the northern border states as far west as Minnesota, south along the Appalachians to northern Georgia and eastern Tennessee. Zones B, **C**, **D**, and E.

Uses — The species possesses little economic importance. Occasionally cultivated for ornament in arboretums and parks. The wood is sometimes used for fuel.



Sugar Maple, Black Maple

Acer saccharum Marsh. [Acer saccharinum Wang.]

1. A twig-tip showing staminate flowers x ½
2. A staminate flower, lateral view x 2
3. A twig-tip showing pistillate flowers x ½
4. A perfect flower, lateral view x 2
5. A branch showing mature leaves and fruit x ½
6. Winter twig x ½

ACERACEAE

Acer saccharum Marsh. [Acer saccharinum Wang.]

Sugar Maple, Black Maple

Habit — A valuable timber species usually 50–80 feet in height with a trunk diameter of 2–3 feet, under optimum conditions sometimes 120 feet tall with a trunk 3–4 feet through. In the open the bole divides 8–10 feet above the ground into stout, ascending branches which form a broad, ovoid, round-topped crown. Trees under forest conditions have long, straight, columnar boles often free of branches for 60–70 feet and bearing shallow, rounded crowns with a few large limbs.

Leaves — Opposite, orbicular to broadly obovate, 3–5 inches across, cordate or rounded at the base, palmately 3–5-nerved and lobed, the lobes acuminate, sparingly sinuately toothed and separated by rounded sinuses. At maturity the leaves are rather thin, glabrous, dark green and dull above, paler and smooth below, borne on slender, glabrous petioles 1½–3 inches long.

Flowers — Appearing in April and May with the leaves, greenish yellow, polygamous, the staminate and pistillate flowers on the same or on different trees, borne on long, filamentous, hairy pedicels in drooping, many-flowered, nearly sessile, umbel-like corymbs from terminal leafy buds or lateral flower-buds. Calyx campanulate, hairy without, 5-lobed, the lobes shallow and obtuse. Corolla wanting. Stamens 7–8, exserted in the sterile flowers, with slender, glabrous filaments and oval anthers. Pistil consisting of a sessile, broadly obovate, laterally-compressed, pale green, pilose ovary surmounted by 2 filamentous styles united at the base and bearing long, exserted stigmas.

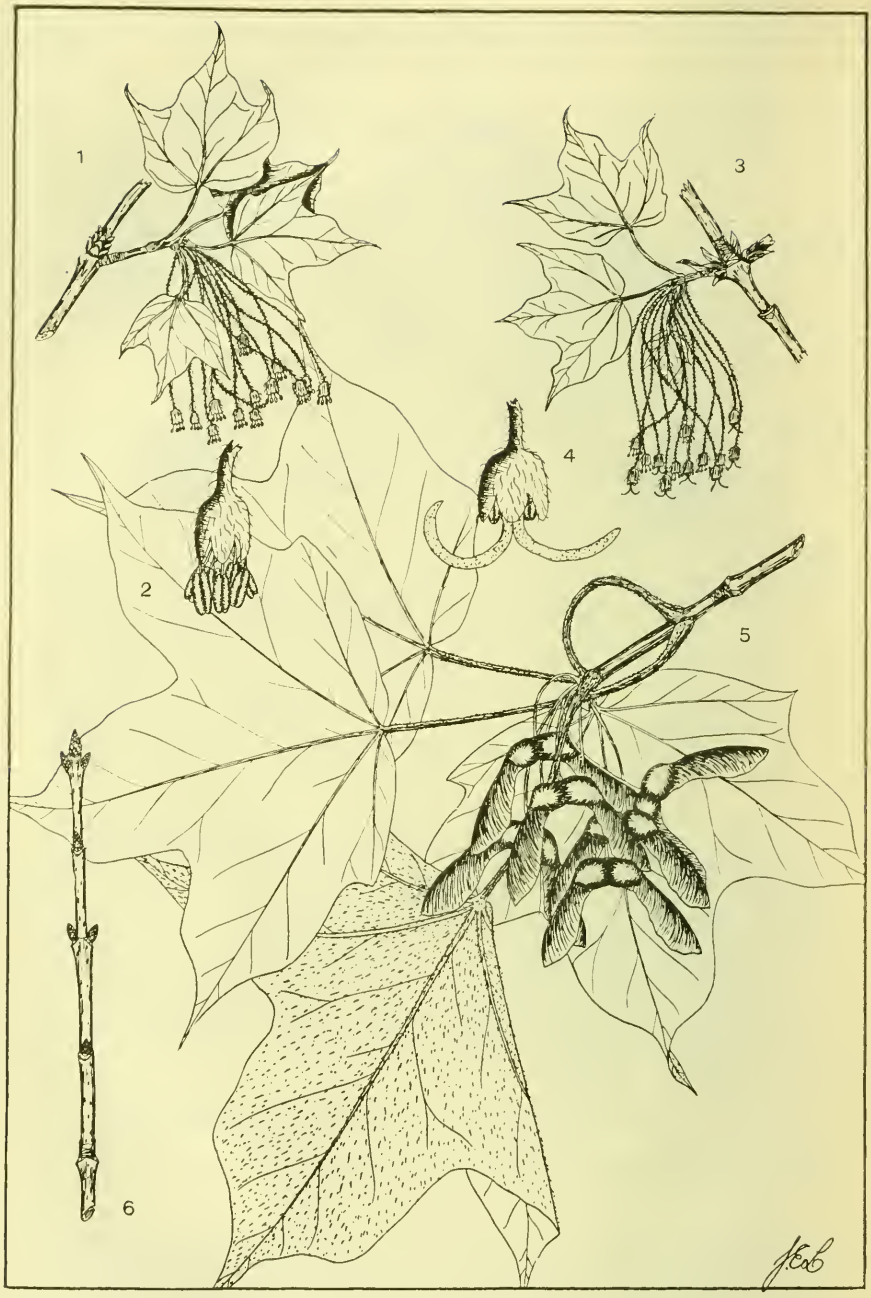
Fruit — A glabrous, double samara consisting of 2 light reddish brown, laterally compressed, 1-seeded carpels about ¼ of an inch long, equipped on the back with broad, thin, divergent wings ½–1¼ inches long. The samaras are borne in clusters on long, smooth, filamentous stalks.

Winter characters.— Twigs slender, lustrous, reddish brown to buff, marked by numerous, conspicuous lenticels, becoming paler the second season. Terminal bud conical, reddish brown, hairy toward the apex, with 8–16 visible scales, about ⅕ of an inch long. Lateral buds opposite, similar to the terminal bud but smaller. Mature bark thick, light grayish brown, separated by deep furrows into longitudinal ridges which are scaly at the surface, that of smaller trunks quite smooth.

Habitat — An upland species preferring the rich, well-drained, rocky soils of slopes, ridges and hills. Thrives on sites underlaid with limestone.

Range — Newfoundland westward to Manitoba and the Dakotas, south to Florida and northeastern Texas. Zones B, **C**, and **D**.

Uses — One of the most valuable timber trees of the forests of eastern United States. Wood hard, heavy, strong, close-grained, pale reddish brown with narrow, paler heartwood. Largely used for furniture, flooring, interior finish, turnery, and for fuel in the rural districts. Bird's-eye and curly maple are especially prized in cabinet work. This tree is tapped in the spring and produces the maple syrup and sugar of the trade. It makes an excellent shade and ornamental tree and is commonly planted along country roads and on private estates.



Black Maple

Acer saccharum, var. nigrum (Michx. f.) Britt. [Acer nigrum Michx. f.]

1. Portion of a branch showing staminate flowers and immature leaves x ½
2. A staminate flower, lateral view x 2
3. Portion of a branch showing pistillate flowers and immature leaves x ½
4. A pistillate flower, lateral view x 2
5. A branch showing mature leaves and fruit x ½
6. Winter twig x ½

ACERACEAE

Acer saccharum, var. nigrum (Michx. f.) Britt. [Acer nigrum Michx. f.]

Black Maple

Habit — Similar in habit to Sugar Maple and not distinguished in the trade, a valuable timber species, becoming under optimum conditions 80–100 feet in height with a trunk 3–4 feet in diameter. In the open the crown is ovoid, at length becoming broad and round-topped. Under forest conditions the bole is long and columnar, bearing aloft a shallow, flat-topped crown.

Leaves — Opposite, orbicular to broadly obovate, 3–5 inches across, cordate at the base, palmately 3-veined and 3-lobed (rarely 5), the lobes acuminate, entire or somewhat undulate, and separated by broad, rounded sinuses. At maturity the leaves are rather thick, dull, dark green and glabrous above, yellow-green and pubescent below, borne on rather stout, pubescent petioles 2–5 inches long.

Flower — Similar to those of Sugar Maple, but opening a few days later than those of the species when the leaves are about one-third grown.

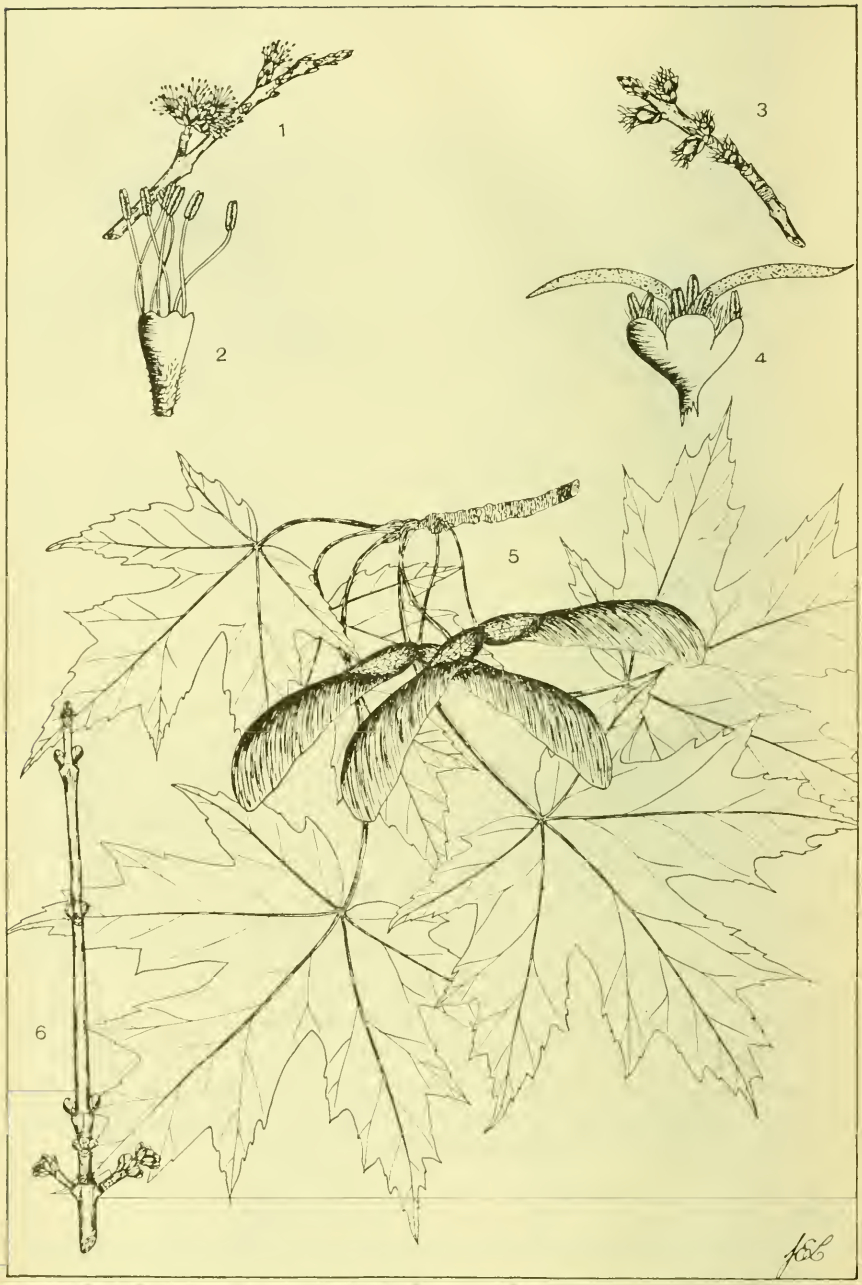
Fruit — Similar to that of Sugar Maple and not to be distinguished from it.

Winter characters — Twigs rather stout, lustrous or dull, orange-brown or grayish brown, marked by conspicuous, oblong, grayish white lenticels. Terminal bud conical to ovate, grayish brown, hoary pubescent, about ¼ of an inch long. Lateral buds opposite, similar to the terminal bud but smaller. Mature bark similar to that of Sugar Maple and not to be distinguished from it.

Habitat — The Black Maple is said to prefer lower ground than the Sugar Maple. In central New York it grows on upland sites, intermixed with or in places wholly replacing the Sugar Maple.

Range — Quebec westward to South Dakota and Kansas, southward to northern Georgia and Louisiana. Zones B, C, and D.

Uses — A valuable timber species. Wood similar to that of Sugar Maple and not distinguished in the trade. The trees are tapped indiscriminately with those of Sugar Maple for their sugary sap.



Silver Maple, White Maple

Acer saccharinum L. [Acer dasycarpum Ehrh.]

1. A twig showing staminate flowers and unopened leaf-buds x ½
2. A staminate flower, lateral view x 10
3. A twig showing pistillate flowers and unopened leaf-buds x ½
4. A pistillate flower, lateral view x 8
5. A branch showing mature leaves and fruit x ½
6. Winter twig x ½

ACERACEAE

Acer saccharinum L. [Acer dasycarpum Ehrh.]

Silver Maple, White Maple

Habit — A large tree 60–80 feet in height with a trunk diameter of 2–4 feet, under favorable conditions sometimes 120 feet tall. Bole usually short, dividing 10–15 feet above the ground into several stout, ascending limbs which ultimately bear brittle, pendulous branches and form a broad-topped, rounded crown.

Leaves — Opposite, nearly orbicular, 6–7 inches across, cordate or truncate at the base, palmately 5-nerved and deeply 5-lobed, the lateral lobes acuminate, coarsely and irregularly dentate and separated by acute sinuses, the terminal lobe usually with three divergent secondary lobes. At maturity the leaves are thin, pale green and glabrous above, silvery-glaucous beneath, borne on slender, drooping, red petioles 4–5 inches long.

Flowers — Appearing during the first warm days of March and April before the leaves in dense, sessile, axillary clusters on the growth of the preceding season, greenish yellow, polygamous, the staminate and pistillate in separate clusters on the same or on different trees. Calyx tubular in the staminate flower, urn-shaped in the pistillate flower, shallowly 5-lobed, usually pubescent without. Corolla lacking. Stamens 3–7, long exserted in the staminate flower, with slender filaments and red anthers. Pistil consisting of a short, compressed, pubescent, 2-lobed ovary surmounted by 2 widely divergent styles with stigmatic tips.

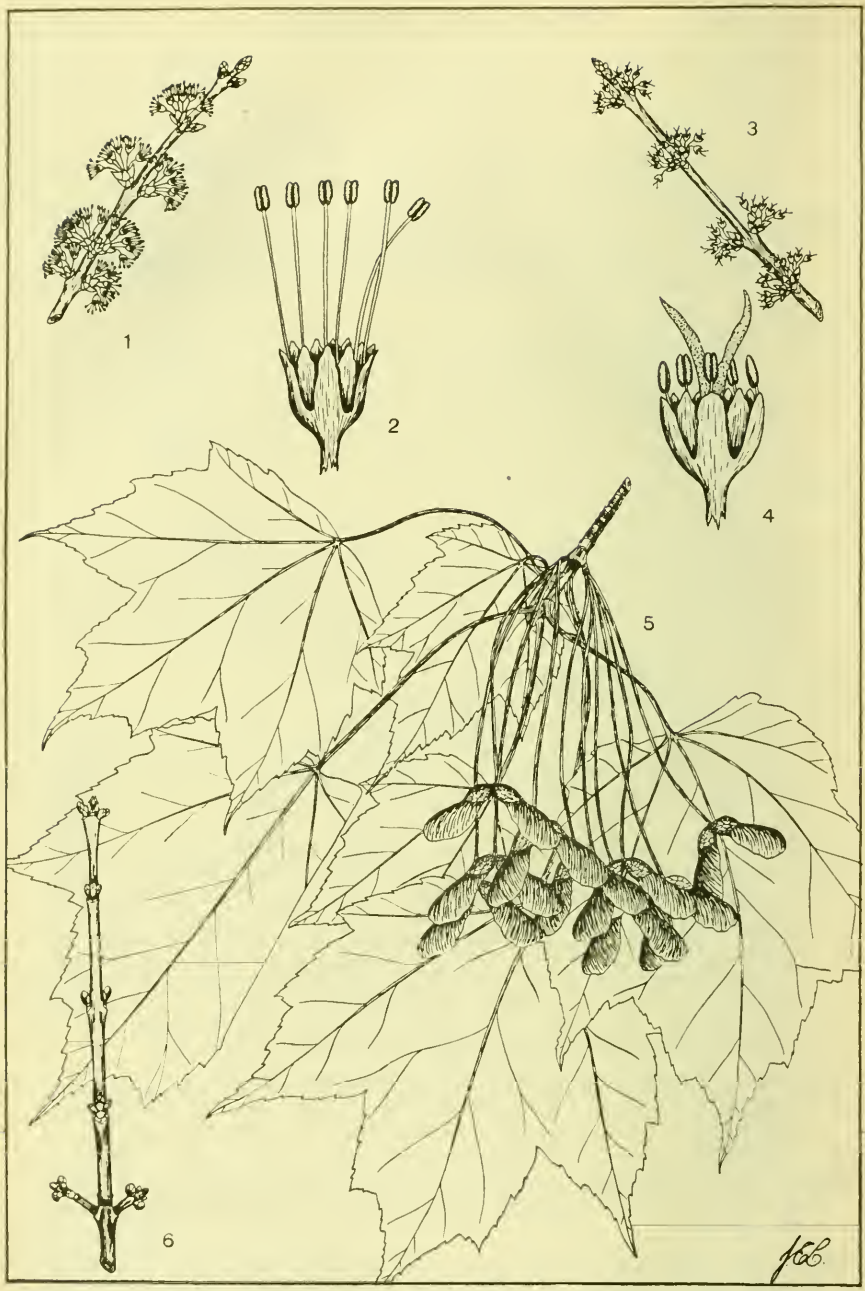
Fruit — A glabrous, double samara consisting of 2 pale, reddish brown and wrinkled, laterally compressed, 1-seeded carpels about ½ of an inch long bearing from the back straight or somewhat falcate, widely divergent wings 1–2 inches long, borne on slender, drooping stalks. The samaras mature in April and May and the seeds germinate as soon as they fall to the ground.

Winter characters — Twigs rather slender, lustrous, conspicuously lenticellate, light chestnut-brown becoming paler the second season. When freshly cut or broken, the twigs exhale a rank odor. Terminal bud ovate-oval, obtuse, red, about ⅕ of an inch long, covered with 3–4 pairs of visible scales which are rounded and ciliate on the margin. Lateral leaf-buds similar, short-stalked, usually accompanied by globose flower-buds on either side which are larger and more conspicuous than the true axillary bud. Mature bark thin, reddish brown, separating at the surface into elongated, loose, longitudinal plates giving the tree a shaggy appearance, that of young trunks and branches smooth and light gray.

Habitat — Typically a bottom-land species preferring moist situations along sluggish streams and the borders of swamps where the soil is often inundated for a part of each year. Propagated for shade and ornament in drier soils.

Range — New Brunswick westward through southern Ontario to eastern South Dakota and Nebraska, south to Florida and Oklahoma. Zones B and C.

Uses — The chief value of the species lies in its use as an ornamental and shade tree, a number of horticultural varieties being recognized. This tree should not be planted in exposed situations as the branches are brittle and subject to storm injury. Wood medium hard heavy, strong, brittle, close-grained, pale brown with thick, paler sapwood. Used for cheap furniture and occasionally for flooring.



Red Maple, Swamp Maple

Acer rubrum L.

1. A twig showing staminate flowers and unopened leaf-buds x ½
2. A staminate flower, lateral view x 5
3. A twig showing pistillate flowers and unopened leaf-buds x ½
4. A pistillate flower, lateral view x 5
5. A branch showing mature leaves and fruit x ½
6. Winter twig x ½

ACERACEAE

Acer rubrum L.

Red Maple, Swamp Maple

Habit — Generally a medium-sized tree 40–50 feet in height with a trunk diameter of 1–2 feet, under favorable conditions occasionally becoming 100 feet tall with a trunk 4 feet in diameter. In the open the bole is usually 6–10 feet long and branches low down into stout, spreading, upright and horizontal branches to form a compact, narrow, oblong or obovoid head. Under forest conditions the bole is much longer and bears a restricted crown.

Leaves — Opposite, orbicular or obovate, 2–6 inches long, truncate or subcordate at the base, palmately 3–5-nerved and lobed, the lobes acute or acuminate, irregularly doubly serrate and separated by shallow, acute sinuses. At maturity the leaves are light green and glabrous above, pale greenish white and glabrous below aside from the prominent veins, borne on slender, red or green petioles 2–4 inches long.

Flowers — Appearing in March and April in advance of the leaves in dense, sessile, axillary clusters on the growth of the preceding season, scarlet or yellowish red, polygamous, pedicellate, the staminate and pistillate in separate clusters on the same or on different trees. Calyx campanulate, deeply 5-lobed, the lobes oblong and obtuse. Petals 5, oblong or linear, equaling the calyx-lobes. Stamens 5–8, exserted in the staminate flowers, with slender filaments and scarlet anthers. Pistil consisting of a glabrous, compressed, laterally lobed ovary and 2 widely divergent styles which bear elongated stigmatic lobes.

Fruit — A glabrous, scarlet or reddish brown, double samara consisting of 2 somewhat striate, laterally compressed, seed-like carpels about ¼ of an inch long bearing from the back thin, erect, divergent wings ½–1 inch long, borne in clusters on drooping stalks 3–4 inches long. The samaras mature in May and June and the seeds usually germinate at once.

Winter characters — Twigs rather slender, lustrous, pale lenticellate, light or dark red, at length gray tinged with red, odorless when crushed. Lateral leaf-buds opposite, oval-ovate, obtuse, red, short-stalked, about ⅛ of an inch long, covered with 3–4 pairs of visible scales which are rounded and ciliate on the margins. Terminal bud similar but slightly larger. Flower-buds numerous, stout, collateral, usually one on either side of the leaf-bud. Mature bark thin, dark gray, divided by shallow fissures into long, longitudinal ridges which separate into long plates at the surface giving the tree a shaggy appearance, that of young trunks and branches smooth and light gray resembling Beech.

Habitat — Typically a bottom-land species inhabiting and attaining its best development on river banks and in low, wet swamps in company with Black Ash, Red Gum, Pepperidge, etc., or often occupying such sites to the exclusion of other species. It also frequents higher ground, often forming an important part of the forest in hilly areas in company with other species.

Range — Nova Scotia westward through southern Canada to Manitoba, south to Florida and eastern Texas. Zones A, B, C, and D.

Uses — This species possesses ornamental value, more especially because of its foliage which is whitened beneath and turns red or scarlet in the autumn. It is to be recommended for roadside and park planting but is not sufficiently hardy for city streets. Wood medium hard, heavy, not strong, close-grained, light brown often with a roseate cast, with thick paler sapwood. Used for cheap furniture, flooring, in turnery and for woodenware.

Box Elder, Ash-leaved Maple

Acer Negundo L. [Negundo aceroides Moench.]

1. A twig showing staminate flowers and opening leaf-buds x ½
2. A staminate flower, lateral view x 3
3. A twig showing pistillate flowers and immature leaves x ½
4. A pistillate flower, lateral view x 2
5. A mature leaf x ⅕
6. Portion of twig with fruit clusters x ½
7. Winter twig x ½

ACERACEAE

Acer Negundo L. [Negundo aceroides Moench.]

Box Elder, Ash-leaved Maple

Habit — A tree of medium size, under favorable conditions attaining a height of 50–75 feet with a trunk 2–4 feet in diameter. Bole usually short, dividing low down into stout, spreading limbs to form a broad, rounded, bushy crown, occasionally long and free of branches for some distance.

Leaves — Opposite, odd-pinnately compound or in part decompound, 6–15 inches long, long-petioled, consisting of 3–5 (rarely 9) leaflets. Leaflets ovate-lanceolate, oval, or obovate, acuminate at the apex, cuneate or rounded at the base, coarsely and irregularly serrate above the middle or deeply lobed or divided, at maturity thin, light green, glabrous or somewhat pubescent above, paler and nearly smooth below, borne on stout petioles, that of the terminal leaflet often 1 inch long.

Flowers — Appearing in April or May with or before the leaves on the growth of the preceding season, yellowish green, dioecious, the staminate in fascicles with long, pendulous pedicels 1–2 inches long, the pistillate in narrow, drooping racemes. Calyx hairy without, campanulate and obscurely 5-lobed in the staminate flower, tubular and deeply lobed in the pistillate flower. Corolla wanting. Stamens 4–6, exserted, with slender filaments and elongated anthers. Pistil consisting of a short, compressed, pubescent, laterally lobed ovary surmounted by elongated styles which are stigmatic along the inner surface.

Fruit — A glabrous, double samara consisting of 2 pale, reddish brown acutely diverging 1-seeded carpels, ⅖–⅗ of an inch long, bearing thin, reticulately veined, straight or somewhat falcate wings 1½–2 inches long, borne in drooping racemes, ripening in the autmun and separating from the fruit stalks which persist on the twigs during the winter.

Winter characters — Twigs stout, green or purplish green, smooth, lustrous or covered at least toward the tips with a glaucous bloom, marked by scattered, pale lenticels. Terminal bud ovoid, acute, pale tomentose about ⅛ of an inch long. Lateral buds opposite, short-stalked, obtuse, shorter than the terminal bud, nearly or quite enclosed by the first pair of bud-scales which commonly bear lateral accessory-buds in their axils. Mature bark thin, pale gray or light brown, shallowly fissured with narrow, anastomosing ridges.

Habitat — A moisture-loving species preferring the banks of streams and rivers, margins of lakes, and low bottom-lands in company with other species. It is often planted and will thrive in drier situations.

Range — Western Vermont southward to Florida, westward through southern Ontario to the eastern slopes of the Rocky Mountains, Texas, New Mexico and Arizona. Rare east of the Appalachian Mountains. Zones A, B, and C.

Uses — Of little commercial importance as a timber tree. Wood soft, light, not strong, close-grained, creamy white. Occasionally manufactured into cheap furniture, woodenware, paper pulp, etc. The tree possesses some ornamental value and is planted extensively in the east as a shade, lawn, and roadside tree. A number of horticultural forms are recognized. A variety (*A. Negundo, var. Californicum* Sarg.) occurs in California.

Horse Chestnut

Aesculus Hippocastanum L.

1. An inflorescence, lateral view x ½
2. A staminate flower, lateral sectional view x 1
3. A perfect flower, lateral sectional view x 1
4. A mature leaf x ½
5. Mature fruit, lateral view x ½
6. Winter twig x ½

SAPINDACEAE

Aesculus Hippocastanum L.

Horse Chestnut

Habit — A large tree, under favorable conditions sometimes attaining a height of 70–80 feet with a trunk diameter of 2–3 feet. Trunk continuous into the crown or more frequently dividing 6–8 feet above the ground into a number of stout, ascending limbs and spreading branches which form an oblong or broadly conical crown. Lower branches drooping, with upturned tips.

Leaves — Opposite, palmately compound, 6–15 inches in diameter, consisting of 5–7 (usually 7) leaflets, borne on stout petioles which are swollen at the base and measure 4–7 inches in length. Leaflets obovate, 4–8 inches long, abruptly acuminate at the apex, tapering to a sessile base, irregularly crenate-dentate, at maturity dark green, rugose, and nearly glabrous above, paler beneath.

Flowers — Appearing in June and July after the leaves, polygamous, in compact, terminal, upright thyrses 6–12 inches high, only those near the base of the inflorescence fertile. Calyx campanulate, finely pubescent, usually gibbous on the lower side near the base, 5-lobed. Petals 5, white spotted with yellow and purple, unequal in size, inserted by a claw at the base. Stamens 6–8, longer than the petals, with slender, upcurving filaments and small, elliptical anthers. Pistil consisting of an oblong, pubescent ovary terminated by an elongated, slender, upcurving style and terminal stigma.

Fruit — A light green, coriaceous, echinulate, 3-celled capsule, 2–3 inches in diameter, turning brown in the autumn and opening by several sutures to set free the 1–3 large, lustrous, brown seeds, each marked by a conspicuous scar.

Winter characters — Twigs stout, reddish brown, glabrous, or finely pubescent, marked by the large, inversely triangular leaf-scars which enclose a U-shaped line of 5–7 bundle-scars. Twigs fork after flowering, an axillary bud then functioning as a terminal bud. Buds large, reddish brown, water-proofed with a sticky gum. Terminal flower-buds, ¾–1 inch long, much larger than the lateral buds. Bud-scales opposite, paired, about 5 pairs visible in the largest buds. Mature bark thin, dull brown, shallowly fissured into small, irregular plate-like scales.

Habitat — Prefers deep, moist soils. Extensively planted as a shade and ornamental tree in this country and found as an "escape" along highways and about the habitations of man.

Range — Originally from southern Asia but now much planted in America and Europe as a shade and ornamental tree. Zones A, B, and C.

Uses — Its chief value lies in its extensive use as a shade and ornamental tree. A number of horticultural varieties including forms with laciniate leaves and double flowers are propagated. Wood light, soft, not strong, close-grained, pale yellowish white. Employed in Europe in carving, turnery and as blind-wood in veneering.

Common Buckthorn , Waythorn, Plumberry

Rhamnus cathartica L.

1. A twig showing staminate flowers and immature leaves x ½
2. A staminate flower, lateral sectional view x 5
3. A twig showing pistillate flowers and immature leaves x ½
4. A pistillate flower, lateral sectional view x 5
5. A branch showing mature leaves and fruit x ½
6. Fruit, lateral view, showing nutlets x 2
7. Nutlet, dorsal view x 3
8. Winter twig x ½

RHAMNACEAE

Rhamnus cathartica L.

Common Buckthorn, Waythorn, Plumberry

Habit — A large shrub or small tree occasionally becoming 30 feet in height with a stout trunk 6–12 inches in diameter. Bole short, dividing 2–5 feet above the ground into a number of stout, ascending limbs which form an oblong or globular, bushy crown.

Leaves — Chiefly subopposite, more rarely alternate, tufted, broadly ovate or oval, 1½–3 inches long, abruptly acute or obtuse at the apex, rounded or obtuse at the base, finely crenate-serrate, at maturity dark dull green and glabrous above, paler and glabrous or pubescent beneath, borne on slender petioles ¾–1 inch long.

Flowers — Appearing in May and June after the leaves in 2–5-flowered, axillary clusters, green, 4-merous, dioecious. Calyx-tube in staminate flower cylindrical, in pistillate flower campanulate. Calyx-lobes triangular, acute, ascending or somewhat reflexed. Petals narrow, shorter than the calyx-lobes, inserted with the stamens on the calyx-tube. Stamens shorter than the calyx-lobes, with awl-shaped filaments and oblong anthers. Pistil consisting of a globose, 4-celled ovary surmounted by 4 linear styles which are united below and bear terminal stigmas.

Fruit — A subglobose, lustrous, black drupe, about ¼ of an inch in diameter, containing thin, acrid flesh and 3–4 bony nutlets. Nutlets strongly sulcate on the outer face.

Winter character — Twigs rather slender, pale reddish brown with a grayish evanescent skin, at length brownish black. Shoots of two sorts, long shoots and short, often spinulose, dwarf shoots which bear flowers and tufted foliage during the summer. Buds ovate, acute, appressed, brownish black, about ¼ of an inch long. Mature bark thin, very rough, nearly black in color.

Habitat — In waste places along fence rows and highways where it is widely spread through the agency of birds. Thrives on a variety of upland sites.

Range — Europe and western and northern Asia. Introduced into the country as a hedge plant and now widely naturalized throughout the eastern United States. Zones A, B, and C.

Uses — Its economic status in this country rests on its use as a hedge plant for which it is well adapted because of its compact head of many small, spiny branches, and the ease of propagation. The bark yields a cathartic and a yellow dye. The close-grained wood is sometimes used for turnery and tool handles in the Old World.

Basswood, American Linden

Tilia americana L. [Tilia glabra Vent.]

1. A branch showing inflorescences and mature leaves x ½
2. A flower, lateral sectional view x 4
3. A fruit-cluster with leafy bract x ½
4. Fruit, lateral sectional view x 3
5. Winter twig x ½

TILIACEAE

Tilia americana L. [Tilia glabra Vent.]

Basswood, American Linden

Habit — A valuable timber tree, generally 60–70 feet in height with a trunk 1–3 feet in diameter, under favorable conditions sometimes 120 feet tall and 4½ feet in diameter. Bole straight, continuous into the crown, bearing slender, lateral branches which form a dense, ovoid crown. In the open the lower branches are pendulous and reach within a few feet of the ground. Forest grown specimens have straight, columnar trunks and high crowns.

Leaves — Alternate, broadly ovate to oval, 5–10 inches long, abruptly acuminate at the apex, cordate and inequilateral at the base, coarsely serrate with incurved, glandular teeth, at maturity thick, dark green lustrous and glabrous above, paler and glabrous below aside from tufts of brown hairs in the axils of the prominent veins, borne on slender petioles 1½–2 inches in length.

Flowers — Appearing in early July after the leaves, perfect, fragrant, yellowish white, borne in drooping, cymose clusters on long peduncles which are united for about half their length with conspicuous pale green bracts. Sepals 5, lanceolate, pubescent, about ¼ of an inch long. Petals 5, lanceolate, longer than the sepals, with a spatulate staminode at the base. Stamens numerous, hypogynous, shorter than the petals, collected in 5 groups one of which is inserted at the base of each staminode. Pistil consisting of a sessile, pubescent globose, 5-celled ovary crowned by an erect style bearing a 5-lobed stigma at the tip.

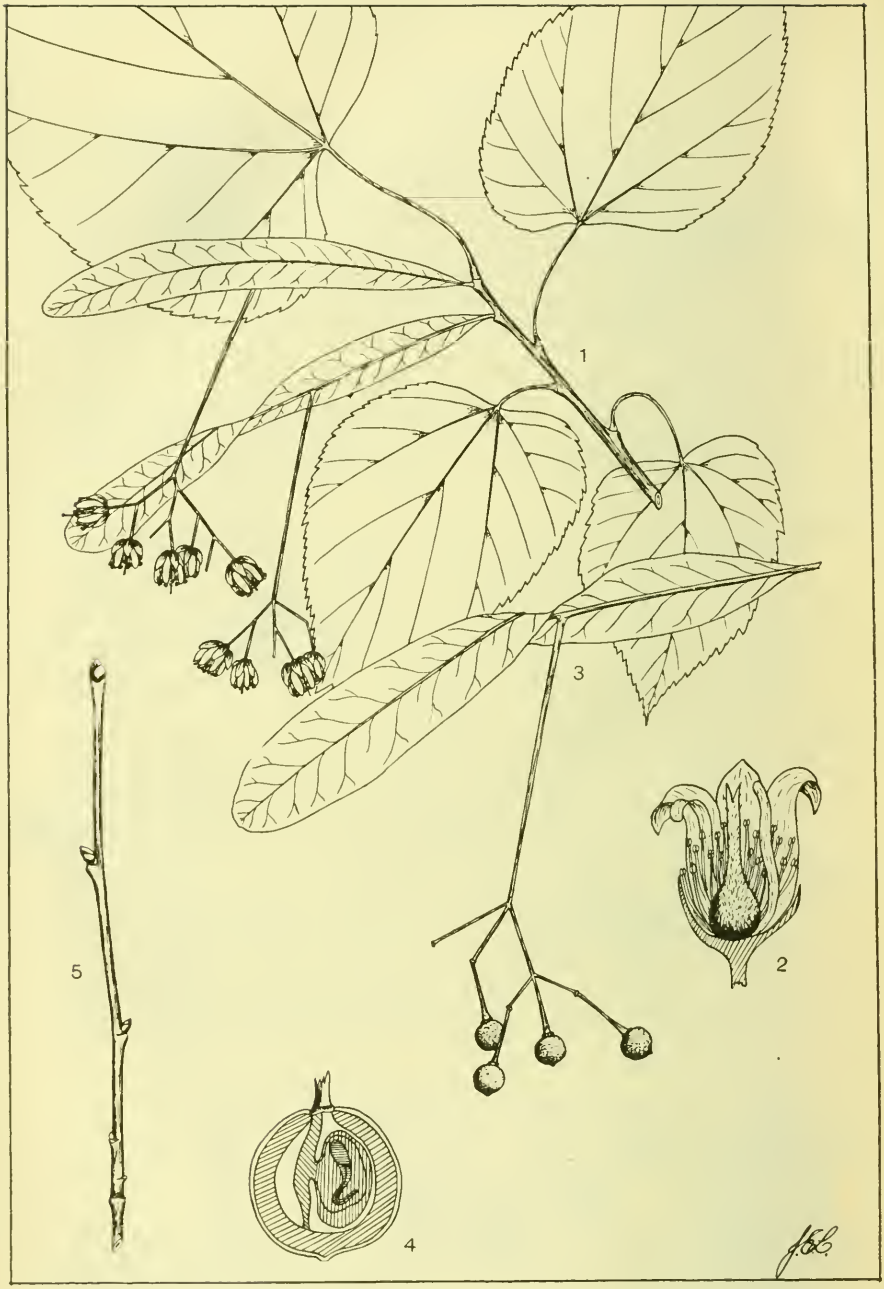
Fruit — An ovoid, obscurely ribbed, apiculate, tawny-brown, pubescent, woody, nut-like drupe, about the size of a pea, borne in cymose clusters on a long stalk attached at the base to the persistent, leafy bract, usually persisting on the trees far into the winter. Fruiting bract usually tapering or stalked at the base. Drupe 1-celled and usually 1-seeded by abortion. Seed broadly ovoid, about ⅕ of an inch long.

Winter characters — Twigs rather slender, zigzag, glabrous, lustrous, bright red, becoming olive-red or covered with a gray, evanescent skin the second season, marked with scattered, oblong lenticels. Terminal bud lacking. Lateral buds ovate, acute, lopsided, divergent, dark red or greenish red, smooth or somewhat pubescent at the apex, ⅕–⅖ of an inch long. Visible bud-scales, 2–3, thick, rounded at the back, inserted separately. Mature bark thick, light brown, divided by deep fissures into rounded, anastomosing ridges which are scaly at the surface. Bark on young stems dark gray and smooth.

Habitat — In rich woods and loamy soils usually in admixture with other species. Thrives in moist, fertile, bottom-land forests.

Range — New Brunswick westward through southern Canada to Manitoba, southward in the United States to Georgia and eastern Texas. Zones A, B, and C.

Uses — A valuable timber species. Wood light, soft, moderately strong, fine-textured and even-grained, light brown to nearly white, with thick, scarcely distinguishable sapwood. Used extensively for crating, cheap furniture, wagons, woodenware, drawing boards, trunks, etc., where a soft, tough, easily worked wood is desirable. Small quantities are manufactured into paper pulp and excelsior. The flowers are nectariferous and are eagerly sought by honey bees. The inner bark is fibrous and mucilaginous and is sometimes manufactured into cordage. The tree possesses ornamental value and is to be recommended for planting in the northern states.



Basswood, Linden

Tilia Michauxii Sarg. [Tilia neglecta Spach.]

1. A branch showing inflorescences and mature leaves x ½
2. A flower, lateral sectional view x 4
3. A fruit-cluster with leafy bract x ½
4. Fruit, lateral sectional view x 3
5. Winter twig x ½

TILIACEAE

Tilia Michauxii Sarg. [Tilia neglecta Spach.]

Basswood, Linden

Habit — A large tree becoming under favorable conditions 70–80 feet in height with a trunk diameter of 2–3 feet. In habit it resembles *Tilia americana* L. and is seldom distinguished from it by layman.

Leaves — Alternate, broadly ovate usually 5–6 inches long, abruptly acuminate or acute at the apex, cordate or truncate and very oblique at the base, sharply serrate with glandular teeth, at maturity thick, dark green, lustrous, glabrous or sparingly pubescent above, grayish green and rather densely pubescent with long hairs below and with prominent tufts of pale hairs in the axils of the principal veins, borne on slender petioles 1½–2 inches in length.

Flowers — Somewhat larger than those of *Tilia americana* and opening a few days later, otherwise similar.

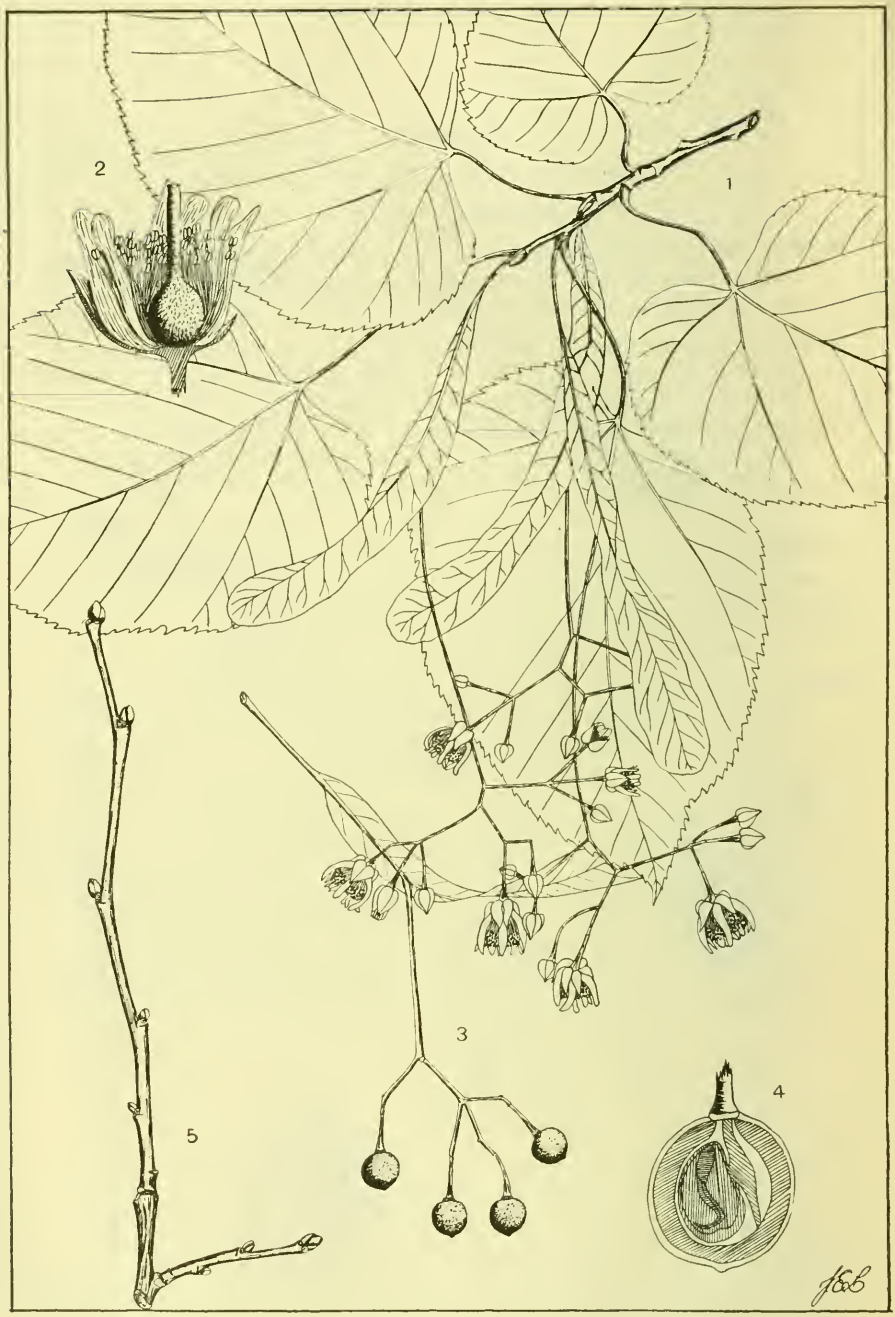
Fruit — Similar to that of *Tilia americana* but smaller (about ¼ of an inch in diameter) and more globose.

Winter characters — The tree cannot be separated with certainty in winter condition from *Tilia americana*. The branches are said to be smoother and lighter colored than those of that species but this character should be used with reservation in identification.

Habitat — Similar to that of *Tilia americana*. Prefers the moist, well-drained soils of rich woods in admixture with other species.

Range — Imperfectly known. Said to extend from southeastern Canada and New England southward into the Gulf states. Zones A, B, and C.

Uses — The wood is not distinguished in the trade from that of *Tilia americana* and is put to the same uses. The tree is occasionally grown ornamentally.



White Linden, White Basswood

Tilia heterophylla, var. Michauxii Sarg.

1. A branch showing inflorescences and mature leaves x ½
2. A flower, lateral sectional view x 4
3. A fruit-cluster with leafy bract x ½
4. Fruit, lateral sectional view x 3
5. Winter twig x ½

TILIACEAE

Tilia heterophylla, var. Michauxii Sarg.

White Linden, White Basswood

Habit — Generally somewhat smaller than the American Linden. A tree usually 50–60 feet in height with a trunk diameter of 3–4 feet, under favorable conditions occasionally 80 feet tall with a trunk 4 feet through. Bole straight, continuous into the crown, under forest conditions long and columnar. Crown at first dense and narrowly pyramidal, at length becoming broad and rounded.

Leaves — Alternate, orbicular-ovate or oblong-ovate, 6–7 inches long, abruptly acuminate at the apex, truncate or cordate and very oblique at the base, sharply serrate with short, slightly incurved, glandular teeth, at maturity membranous, dark green and glabrous above, grayish-white pubescent below, borne on slender petioles 2–3 inches in length.

Flowers — Appearing in July. Larger than those of the American Linden, otherwise similar.

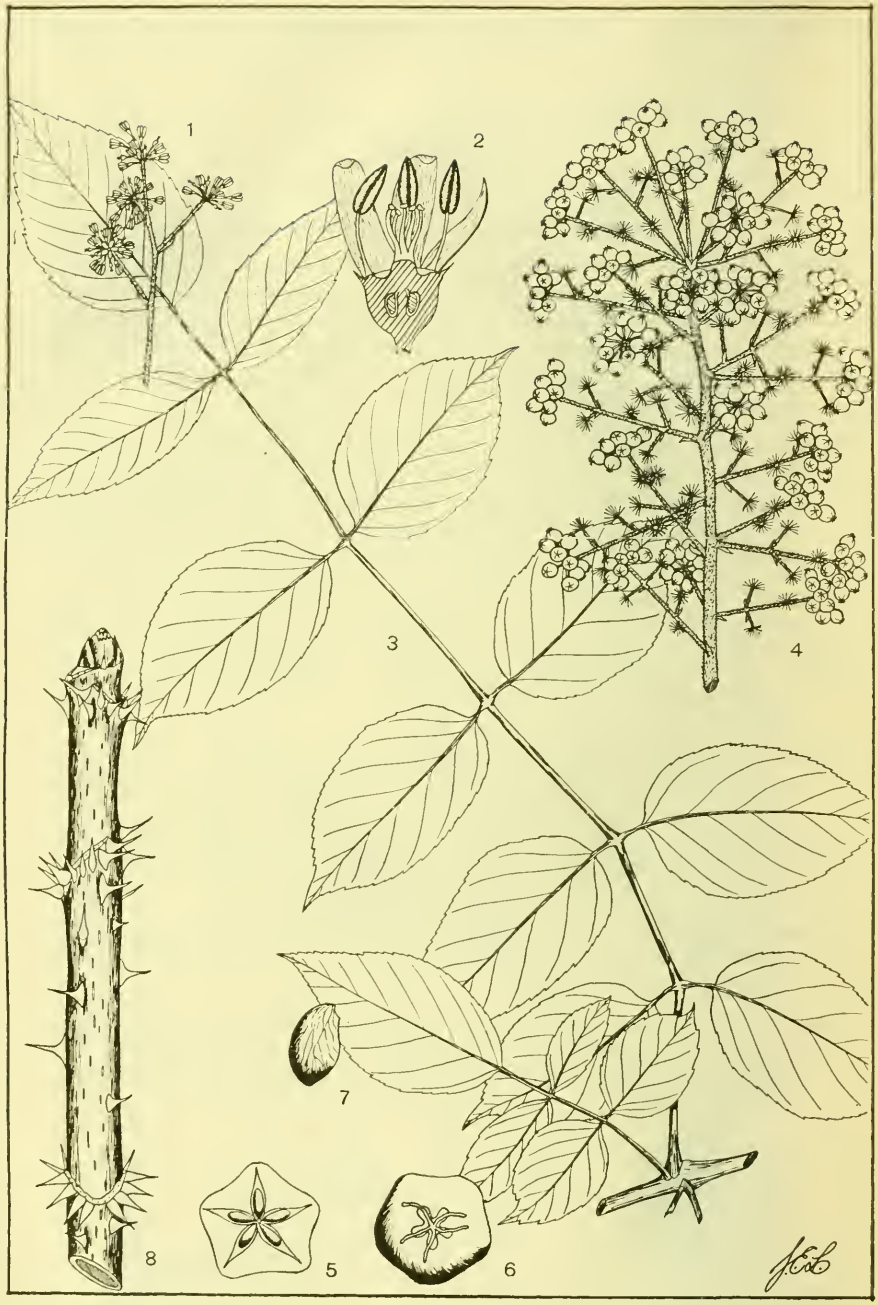
Fruit — Resembles that of *Tilia Michauxii*. Subgobose, rusty-tomentose, about ⅛ of an inch in diameter, 1-celled and usually 1-seeded through abortion.

Winter characters — Twigs generally more slender than those of the Basswood, otherwise similar. Buds usually smaller than those of Basswood. Bark not distinguishable from that of other basswood species.

Habitat — On limestone outcrops and in rich soils on moist slopes, growing in the open or in forests in admixture with other species.

Range — Central New York southward along the Appalachians to northern Alabama, westward to southern Indiana, Illinois and central Tennessee. Zones A, B, and C.

Uses — The wood is not distinguished in the trade from that of Basswood. In New York State this species does not attain the size of Basswood and hence is less valuable. In West Virginia it is an important timber species. Occasionally grown for ornament.



Hercules' Club

Aralia spinosa L.

1. A portion of the inflorescence x 1
2. A perfect flower, lateral sectional view x 10
3. A portion of a compound leaf showing leaflets x ½
4. Terminal portion of a fruit-cluster x ½
5. Fruit, apical sectional view x 3
6. Fruit, apical view x 3
7. Seed, lateral view x 5
8. Winter twig x ½

ARALIACEAE

Aralia spinosa L.

Hercules' Club

Habit — A small tree of rapid growth, usually 20–35 feet in height with a trunk 6–9 inches in diameter, often a shrub sending up coarse, vigorous shoots 10–20 feet in height from stoloniferous roots. Crown flat-topped, consisting of a few stout, spreading branches. Bole generally clean below.

Leaves — Alternate, clustered at the ends of the branches, odd-bipinnately compound, 2–4 feet long, 2–2½ feet wide, borne on long, stout, spinulose petioles which are enlarged at the base and sheath the twigs. Leaflets opposite, short-stalked, broadly ovate to lanceolate, acuminate at the apex, cuneate or rounded at the base, finely serrate, at maturity dark green and glabrous above, paler, glabrous or somewhat pubescent and often with prickles on the midribs beneath. Terminal leaflet long-stalked.

Flowers — Appearing in late July and August, perfect or staminate by abortion, about 1/16 of an inch long, borne on slender, straw-colored pedicels in panicled umbels the branches of which are pale brown, bracteolate and puberulous, the whole forming a terminal paniculate cluster 3–4 feet long. Terminal clusters solitary or 2–3 together above the spreading leaves. Calyx-tube adherent to the ovary, the limb minutely 5-toothed. Petals 5, white, ovate, obtuse, inserted by a broad base on the margin of the disk. Stamens 5, alternate with and about equalling the petals, with slender filaments and ovate anthers. Pistil consisting of an inferior 5-celled ovary surmounted by 5 connivent styles crowned with capitate stigmas.

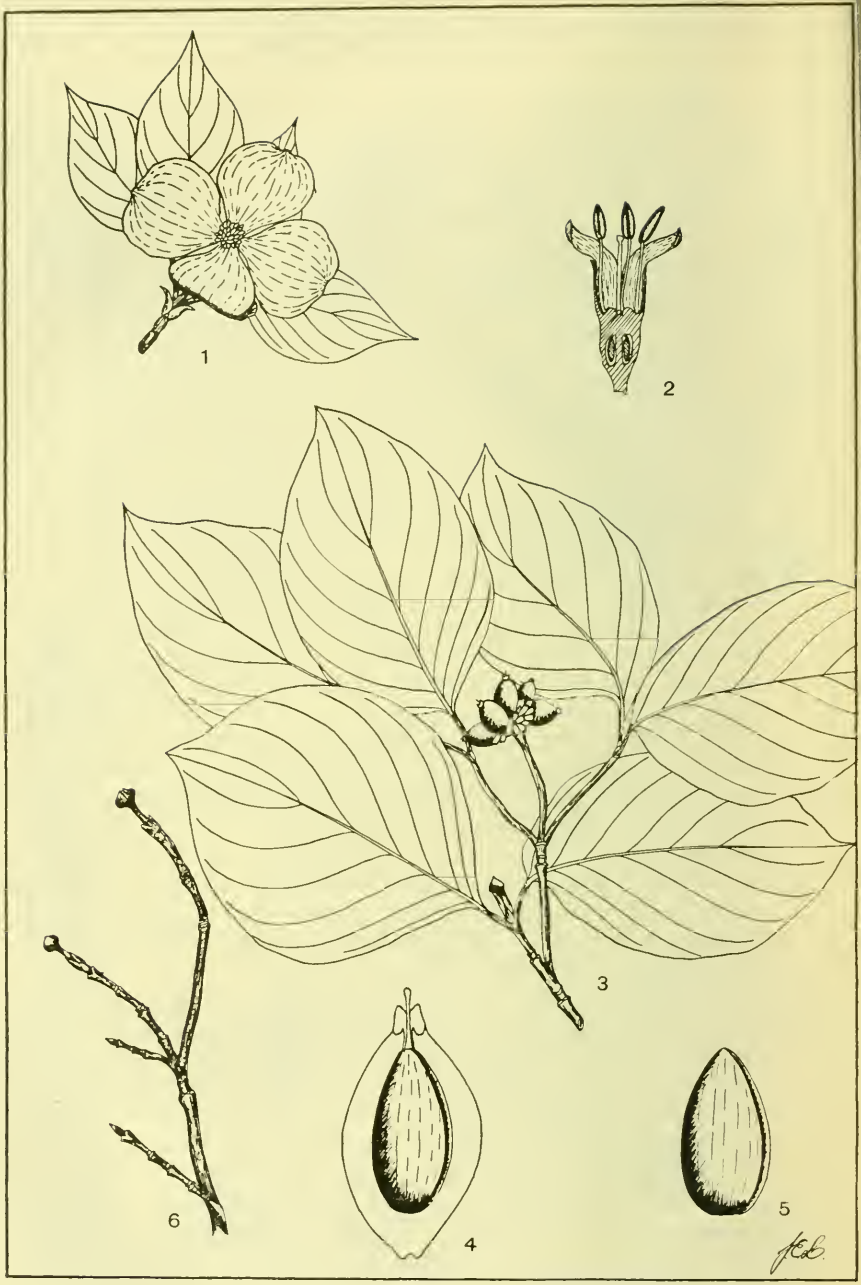
Fruit — An ovoid, 5-angled, black berry about ¼ of an inch in diameter, capped by the blackened, persistent styles. The fruit ripens in late August and September. Seeds oblong, rounded at the end, embedded in the thin, purple, very juicy flesh.

Winter characters — Twigs very coarse, ½–1 inch in diameter, pale orange, lustrous, lenticellate, characteristically armed with stout, irregularly scattered prickles. Leaf-scars narrow, nearly encircling the twig, with a single row of bundle-scars. Terminal bud conical, obtuse, chestnut-brown, ½–¾ of an inch long. Lateral buds much smaller, flattened, appressed, triangular. Mature bark thin, brown, separated by shallow depressions into broad, anastomosing ridges. Inner bark yellow.

Habitat — Fertile bottom-lands and moist or wet woodland slopes. Occasionally found as an "escape" in dumps and waste places.

Range — Southern New York westward through southern Indiana and Illinois to Missouri, southward to Florida and eastern Texas. Zones A and B.

Uses — Of little economic importance aside from its ornamental value. It is a short-lived tree of rapid growth and grotesque habit and is extensively planted for ornament in regions where it is hardy. The bark of the root and the berries possess some medicinal virtues.



Flowering Dogwood

Cornus florida L. [Cynoxylon floridum (L.) Rafinesque]

1. A twig-tip showing terminal inflorescence x ½
2. A flower, lateral sectional view x 3
3. A branch showing mature leaves and fruit x ½
4. Drupe, lateral sectional view x 3
5. Pit, lateral view x 3
6. Winter twig x ½

CORNACEAE

Cornus florida L. [Cynoxylon floridum (L.) Rafinesque]

Flowering Dogwood

Habit — A low, bushy tree 15–30 feet in height with a trunk diameter of 6–10 inches, under optimum conditions occasionally 35–40 feet tall with a trunk 12–18 inches in diameter. Trunk short, with little taper, often oblique, abruptly breaking up 6–10 feet above the ground into a number of stout, elongated, wide-spreading limbs which form a broad, low, flat-topped crown.

Leaves — Opposite, clustered near the ends of the branches, ovate to elliptical or oval with prominent arcuate veins, 3–5 inches long, acute at the apex, cuneate at the base, entire or remotely crenulate, at maturity thick, light green with scattered hairs above, paler and puberulous below. Petioles grooved, ½–¾ of an inch long.

Flowers — Appearing in May and June when the leaves are about half grown, sessile in the axils of small, deciduous bracteoles, the whole forming a dense, terminal head surrounded by an involucre of 4 large, white or pinkish white, obovate, notched, petaloid bracts. Inflorescence 2–4 inches in diameter when fully expanded; individual flowers about ⅛ of an inch across at anthesis. Calyx slightly urceolate, puberulous, somewhat 4-angled and 4-lobed at the top, adherent to the ovary. Petals 4, ligulate, reflexed after anthesis, inserted with the stamens at the top of the ovary. Stamens 4, exserted, with slender filaments and oblong anthers. Pistil consisting of an inferior 2-celled ovary crowned with a slender filiform style and capitate stigma.

Fruit — A bright scarlet, ovoid drupe, about ⅗ of an inch long, crowned with the persistent calyx and withered style, borne in clusters of 3 or more and surrounded at the base by the remnants of abortive flowers. Drupes mature in September and October. Pit ovate, 2-celled, grooved on one side.

Winter characters — Twigs slender, red or yellowish green, usually appearing somewhat mealy from minute, closely appressed pubescence. Leaf-scars decurrent, with V-shaped notch between, those on the older growth nearly encircling the twig. Terminal buds of two sorts. Terminal leaf-bud flattened, conical, covered by a single pair of bud-scales. Terminal flower-buds subglobose, covered by 4 scales which enlarge and turn white in the spring. Lateral buds minute, covered by the persistent bases of the leaf-stalks. Mature bark dark brown to black, broken into quadrangular scales, resembling alligator leather.

Habitat — Attains its best development on rich, well-drained soils along streams and on moist slopes, generally in the shade of other species. Common in open woodland on rocky slopes and ridges.

Range — Central New England westward through New York and southern Ontario to Missouri, southward to Florida and eastern Texas. Zones A, B, and C.

Uses — Wood hard, heavy, strong, close-grained, light reddish brown, with wide, paler sapwood. Largely used in turnery, for shuttles, wheel hubs, tool handles, and occasionally for engraving. It is prized as an ornamental tree because of its unusual form and showy flowers and fruits. A form with bright pink or red flowers is extensively propagated.

Blue Dogwood, Alternate-leaved Dogwood

Cornus alternifolia L. f.

1. Portion of a twig showing inflorescence and leaves x ½
2. A flower with two petals removed, lateral view x 4
3. A branch showing mature leaves and fruit x ½
4. Drupe, lateral sectional view x 3
5. Pit, lateral view x 3
6. Winter twig x ½

CORNACEAE

Cornus alternifolia L. f.

Blue Dogwood, Alternate-leaved Dogwood

Habit — A small tree 20–30 feet in height with a trunk diameter of 6–8 inches or occasionally a foot through, commonly a tall shrub. Trunk short, beginning to divide 2–6 feet above the ground. Crown broad, deep, flat-topped, having a storied appearance owing to clusters of branches which radiate out from the stem at intervals in horizontal planes.

Leaves — Alternate or subopposite, clustered near the branch-tips, ovate, elliptical or oval, 3–5 inches long, acuminate at the apex, cuneate or rounded at the base, obscurely crenulate, at maturity membranous, yellowish green and glabrous or sparingly pubescent above, pale and appressed pubescent beneath, borne on slender pubescent grooved petioles 1½–2 inches long.

Flowers — Appearing in May and June after the leaves, borne on slender, jointed pedicels in flat, puberulous, many-flowered cymes 1½–2½ inches in diameter terminal on short, leafy, lateral branchlets. Individual flowers creamy-white, about ¼ of an inch long. Calyx oblong, pubescent, constricted above and obscurely toothed. Petals 4, oblong, obtuse, reflexed after anthesis, inserted with stamens at the top of the ovary. Stamens 4, exserted, with slender filaments and oval anthers. Pistil consisting of an inferior, 2-celled ovary, surmounted by a columnar style and terminal stigma.

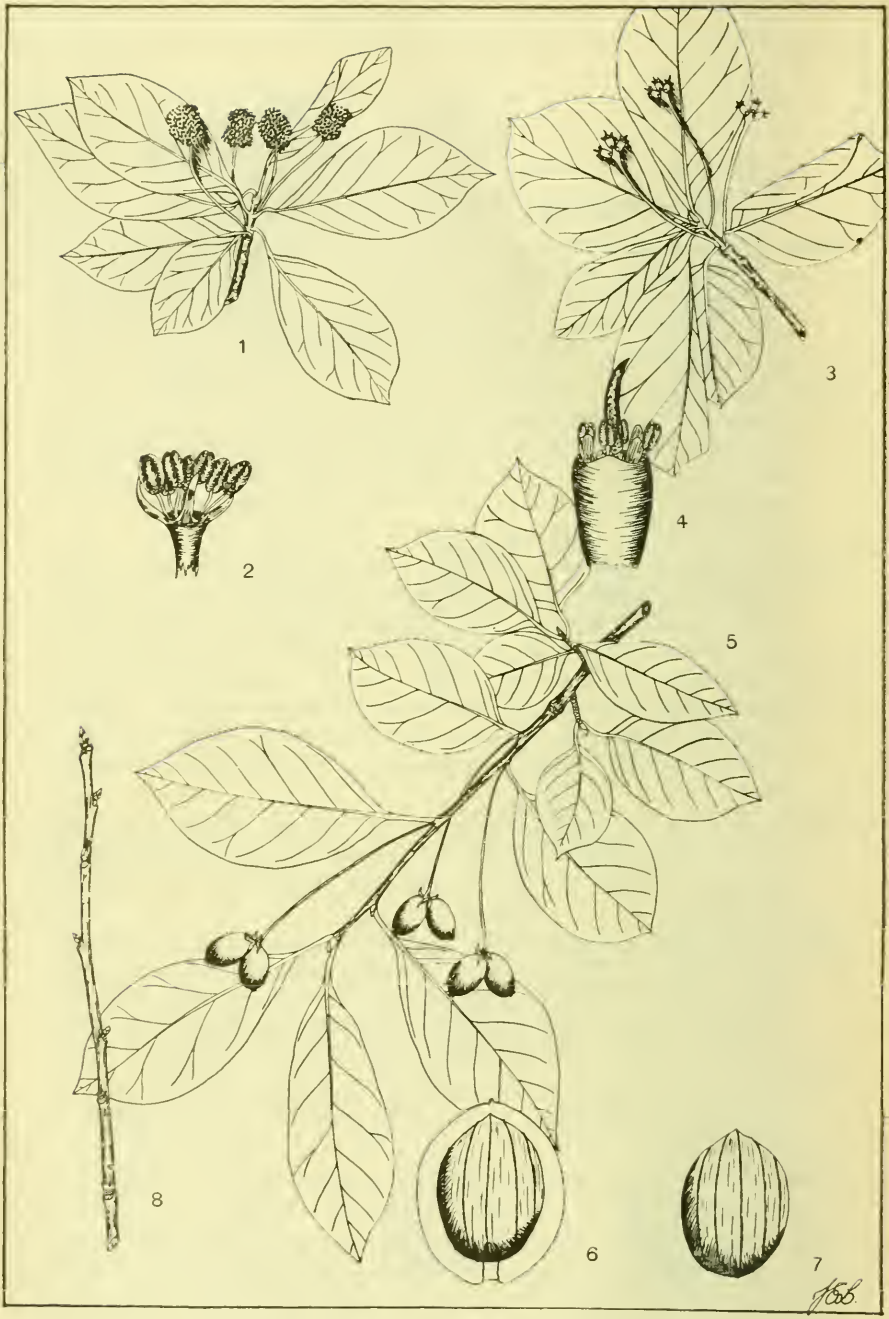
Fruit — A bluish black, subglobose drupe, about ⅓ of an inch in diameter, tipped by the remnant of the style, borne in loose, spreading, red-stemmed clusters. Ripens in October. Pit obovoid, longitudinally many-grooved, 2-celled.

Winter characters — Twigs rather slender, elongated, glabrous and often lustrous, green or greenish brown, ill-scented and bitter to the taste when broken. Buds alternate or subopposite, oval, acute, chestnut-brown, with 2–3 visible scales. Mature bark thin, reddish brown, smooth or divided by shallow, vertical fissures into narrow, interrupted ridges.

Habitat — Rich, well-drained soils along the borders of forests, fence rows, and stream courses, usually in admixture with other species. Tolerant of shade.

Range — Nova Scotia westward through southern Ontario to Minnesota, southward to northern Alabama and Georgia. Zones A, **B**, **C**, and D.

Uses — Of no economic value aside from its use as an ornamental species. It is occasionally propagated in the eastern United States because of its unusual form, profusion of its blossoms and fruit, and the beauty of its autumnal coloration.



Black Gum, Pepperidge, Tupelo

Nyssa sylvatica Marsh. [*Nyssa multiflora* Wang.]

1. A twig showing staminate inflorescences and immature leaves x ½
2. A staminate flower, lateral view x 6
3. A twig showing pistillate inflorescences and immature leaves x ½
4. A pistillate flower, lateral view x 6
5. A branch showing mature leaves and fruit x ½
6. Drupe, lateral sectional view x 2
7. Pit, lateral view x 2
8. Winter twig x ½

CORNACEAE

Nyssa sylvatica Marsh. [Nyssa multiflora Wang.]

Black Gum, Pepperidge, Tupelo

Habit — In New York State generally a medium-sized tree 40–70 feet in height with a trunk diameter of 1–3 feet, farther south occasionally 100 feet tall, at the northern limits of its range often reduced to a shrub. Trunk straight, continuous into the crown, clothed with tough, slender, pendulous branches to within a few feet of the ground. Crown variable, sometimes short, cylindrical and flat-topped, at others pyramidal, conical, or inversely conical and flat-topped.

Leaves — Alternate, oval to obovate, 2–5 inches long, acute at the apex, cuneate at the base, entire or rarely coarsely dentate, at maturity thick, dark green and lustrous above, paler and often hairy below, borne on ciliate petioles ¼–1½ inches long. Leaves turn bright scarlet on the upper side before falling in the autumn.

Flowers — Apearing in May and early June when the leaves are about half grown, yellowish green, polygamo-dioecious, borne on long, slender, hairy peduncles. Staminate flowers in dense, many-flowered heads. Calyx tubular, minutely 5-lobed. Petals ligulate, acute, thick. Stamens 5–10, exserted in the sterile flower, sessile or wanting in the fertile flower. Fertile flowers in bracteolate clusters of 3. Calyx cylindrical, shallowly 5-lobed. Petals ovate, obtuse, blunt, much shorter than the calyx-tube. Pistil consisting of an inferior 1–2-celled ovary surmounted by a terete, pointed style stigmatic toward the tip.

Fruit — An ovoid, dark blue drupe, from ⅓–⅔ of an inch long, borne on long, slender peduncles in clusters of 1–3, ripening in October. Flesh thin, acid. Pit ovoid, slightly compressed, with 10–12 low, longitudinal ribs.

Winter characters — Twigs slender, smooth, grayish to reddish brown, with numerous lateral, short, slow-growing spurs crowded with leaf-scars. Pith diaphragmed-stuffed. Buds ovate, acute, smooth, reddish brown, about ¼ of an inch long, with 3–5 visible scales. Mature bark thick, grayish, divided by deep fissures and interrupted ridges into quadranglar or hexagonal blocks, resembling alligator skin.

Habitat — This species is widely disseminated by birds and grows on a variety of habitats. It attains its best development along stream courses and about the margins of ponds and sluggish streams, but thrives on hillsides and in abandoned pastures.

Range — Southern Maine westward through southern Ontario to central Michigan and southeastern Missouri, southward to Florida and eastern Texas. Zones A, **B**, and C.

Uses — A timber species of secondary importance. Wood heavy, soft, strong, very tough, not durable, difficult to season, pale yellow or nearly white with thick, paler sapwood. Largely used as "thin" lumber in the manufacture of egg- and orange-crates. The toughness of the wood renders it valuable for wheel hubs, rollers, etc. When treated, it is suitable for railroad ties.

Rhododendron, Great Laurel

Rhododendron maximum L.

1. A flowering branch x ½
2. A flower, lateral sectional view x 2
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral view x 1½
5. Seed x 15

ERICACEAE

Rhododendron maximum L.

Rhododendron, Great Laurel

Habit — A shrub 5–12 feet tall, or southward in the mountains becoming a bushy tree 30–35 feet in height with a trunk 10–12 inches in diameter. Trunk generally short, crooked, ascending or often prostrate. Branches stout, contorted, forming a bushy, round-topped crown.

Leaves — Alternate, persistent, clustered near the branch-tips, ovate-lanceolate or obovate-lanceolate, 4–12 inches long, 1½–2⅛ inches wide, acute at the apex, cuneate or rounded at the base, entire and somewhat revolute on the margin, at maturity thick, coriaceous, dark green and lustrous above, pale whitish below, borne on stout petioles 1–1½ inches in length.

Flowers — Appearing in June and July from separate flower-buds formed the previous summer, showy, perfect, pale rose to white in color, borne on slender, glandular-pubescent, pink pedicels in 16–24-flowered umbellate clusters 4–5 inches in diameter. Calyx light green, puberulous, persistent in fruit, with 5 oblong, rounded, rather remote lobes. Corolla campanulate, puberulent in the throat, gibbous posteriorly, cleft to the middle into oval, rounded lobes, the upper one yellow-spotted on the inner face. Stamens 8–12, of varying length, consisting of filaments which are flattened below and bearded with stiff white hairs, and white, oval anthers. Pistil consisting of an ovate, green, glandular-pubescent ovary, terminated by an elongate, slender, declined style, and terminal, scarlet stigma.

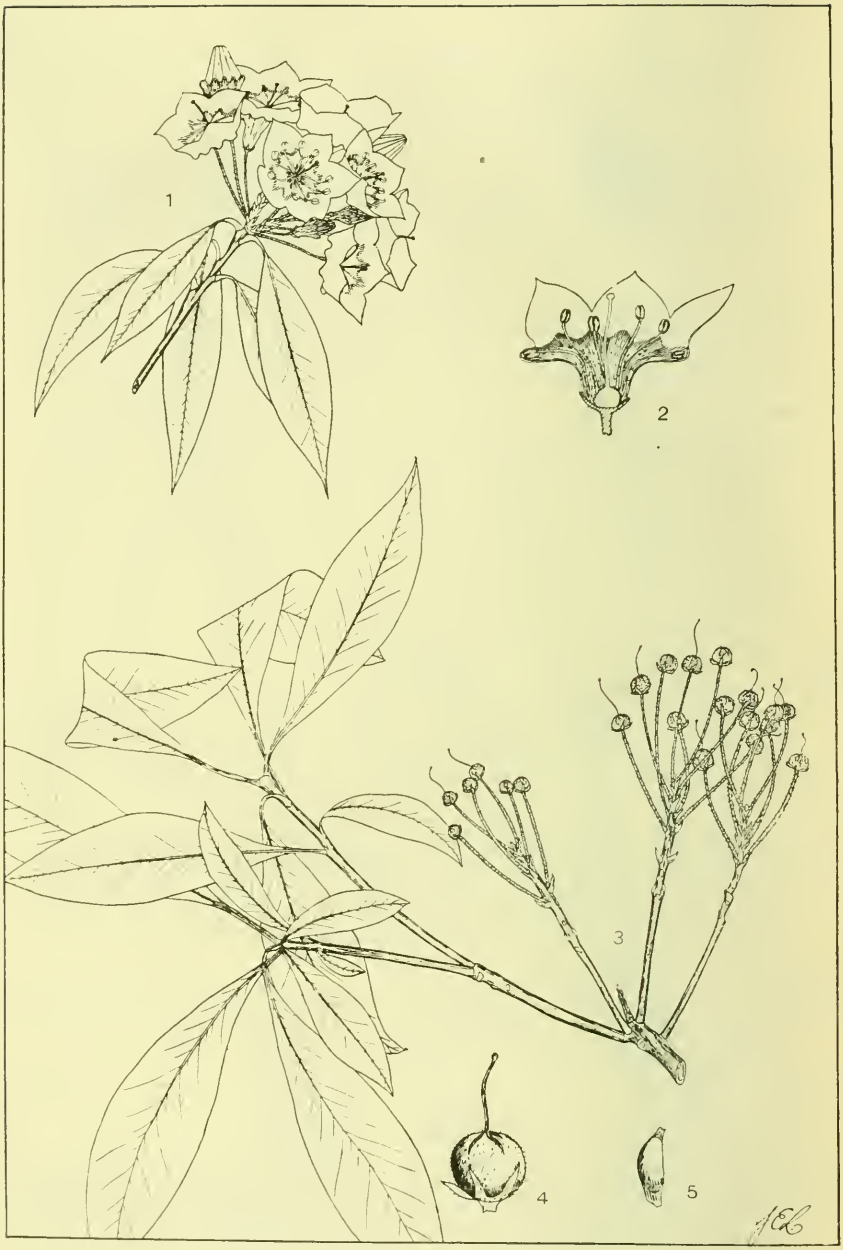
Fruit — An oblong-ovoid, dark reddish brown, glandular-hispid capsule, about ½ of an inch long, subtended at the base by the persistent calyx and crowned with the persistent style. In the autumn the capsule splits septicidally into 5 carpels which separate from the persistent central axis and open down the inner side. Seeds oblong, flattened, winged at the ends. Capsules persist on the twigs until the following season.

Winter characters — Twigs stout, dark green, glabrous, becoming bright reddish brown the second year. Leaf-buds conical, dark green, covered with many closely imbricated scales. Flower-buds usually terminal, cone-shaped, 1–1½ inches long, covered with many imbricated, ovate scales. Mature bark thin, reddish brown, peeling off at the surface into thin scales.

Habitat — At the northern limits of its range, confined to cold, springy swamps. Farther south it is found in moist, shady situations along the precipitous banks of mountain streams and in hilly woods at elevations up to 3000 feet.

Range — Nova Scotia westward to the northern shores of Lake Erie, southward along the mountains to Georgia and Alabama. Zones A and B.

Uses — The Great Laurel is of distinct ornamental value because of its large, coriaceous, persistent leaves and showy flowers. It is often collected in carload lots directly from the woods and used extensively in moist, protected situations in park planting. Like the Mountain Laurel, it will not thrive on limestone soils. Wood heavy, hard, close-grained. Occasionally used in engraving as a substitute for boxwood, for tool handles, etc.



Mountain Laurel

Kalmia latifolia L.

1. A flowering branch x ½
2. A flower, lateral sectional view x 1
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral view x 2
5. Seed x 10

ERICACEAE

Kalmia latifolia L.

Mountain Laurel

Habit — Generally a shrub 5–20 feet in height with a stem 1–6 inches in diameter, farther south at its optimum range occasionally 30–40 feet in height with a trunk 18–20 inches through. Trunk short, stout, often oblique, usually forking into a number of divergent branches which form a compact, round-topped crown.

Leaves — Alternate or occasionally opposite or in whorls of 3, persistent, oblong or elliptic-lanceolate, 3–4 inches long, acute and sometimes bristle-tipped at the apex, cuneate at the base, entire, at maturity thick, coriaceous, dark green and rather dull above, yellowish green and paler below, borne on stout petioles about ⅔ of an inch in length, falling during their second summer.

Flowers — Appearing in May and June from separate flower-buds formed the previous summer, showy, perfect, borne on red or green scurfy pedicels in terminal, compound, many-flowered corymbs about 4 inches in diameter. Calyx divided nearly to the base into 5 narrow, acute, green lobes which persist in fruit. Corolla white or rose-colored, rotate, with 10 pouches below the 5-parted limb. Limb divided into 5 ovate, acute lobes. Stamens 10, hypogynous, shorter than the corolla, with filiform filaments and oblong anthers. Prior to anthesis the anthers are held in the corolla-pouches. At anthesis the "bowed" filaments straighten elastically, raising the anthers aloft and catapulting the pollen from terminal pores.

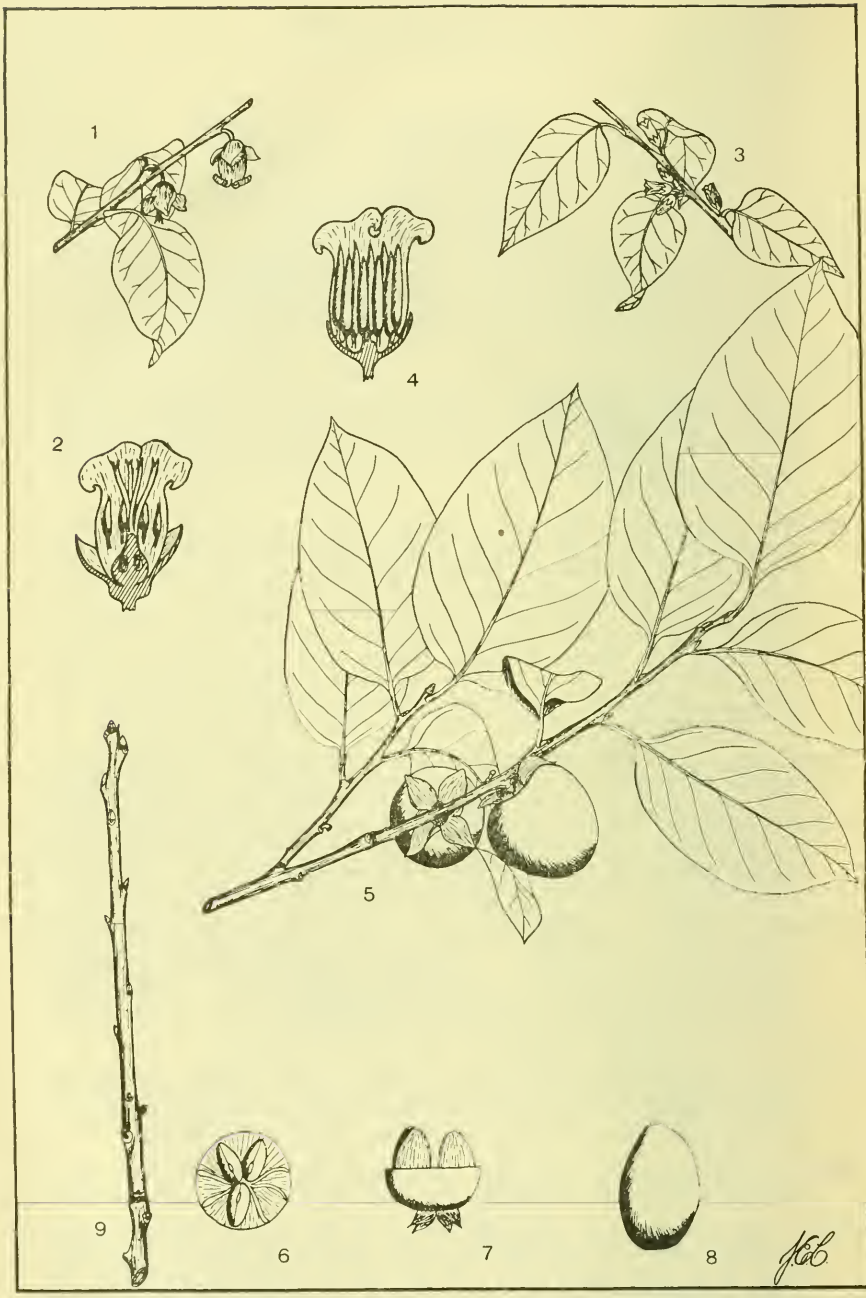
Fruit — A globose, glandular-hispid, slightly 5-angled and 5-celled, woody capsule, about 3/16 of an inch in diamter, crowned by the persistent style and subtended at the base by the persistent calyx, maturing in September and October. At maturity the capsule splits septicidally into 5 carpels which separate from the persistent central axis and open down the inner side by a narrow suture. Mature capsules persist on the plant until the following year. Seeds oblong, numerous, minute, winged.

Winter characters — Twigs reddish green and lustrous, becoming bright reddish brown the second year. Twig-tips often winter killing. Leaf-buds ovate, small, acute, axillary. Flower-buds clustered above the leaf-bud, stouter, covered by numerous, glandular-pubescent scales. Mature bark thin, reddish brown, dissected by longitudinal fissures into narrow ridges which flake into long scales at the surface.

Habitat — At the northern limits of its range, mainly confined to low, rich bottom-lands, farther south thriving on rich, rocky hillsides, often ascending to elevations of several thousand feet and covering extensive tracts in deciduous forests with a dense, almost impenetrable thicket.

Range — New Brunswick westward through southern Ontario and Ohio, southward along the mountains into the Gulf States. Zones A and B.

Uses — One of the most attractive shrubs of the eastern United States, especially when it is covered with showy clusters of white or pink blossoms. It is easily raised from seed and may be readily transplanted. It will not thrive on limestone soils. The addition of leaf-mold as a top dressing to the soil is recommended. Hardy in shady or open situations in central and southern New York.



Persimmon

Diospyros virginiana L.

1. Portion of twig showing pistillate flowers and immature leaves x ½
2. A pistillate flower, lateral sectional view x 2
3. Portion of twig, showing staminate flowers and immature leaves x ½
4. A staminate flower, lateral sectional view x 2
5. A branch showing mature leaves and fruit x ½
6. Fruit in cross section, apical view x ½
7. Fruit in cross section, lateral view x ½
8. Seed, lateral view x 1
9. Winter twig x ½

EBENACEAE

Diospyros virginiana L.

Persimmon

Habit — A small tree 40–50 feet in height with a trunk diameter of 6–12 inches, under optimum conditions occasionally 100 feet tall with a trunk 2–3 feet in diameter. Trunk slender, tapering, continuous into the crown, short or in forest grown specimens often free of branches for 60–70 feet. Crown cylindrical, with slender, spreading or drooping branches, becoming broad and round-topped with age.

Leaves — Alternate, ovate or oval, 3–7 inches long, acuminate at the apex, rounded or subcordate at the base, entire, at maturity thick, coriaceous, dark green and lustrous above, paler and pubescent beneath, borne on stout, pubescent petioles ½–1 inch in length.

Flowers — Appearing in May and June on the shoots of the year when the leaves are partly grown, yellowish green, dioecious, the staminate in 2–3-flowered, pubescent, pedunculate cymes, the pistillate solitary and borne on short, recurved pedicels. Calyx deeply 4-lobed the lobes ovate, acute, accrescent under the fruit. Corolla tubular or somewhat urceolate, with 4 short, reflexed lobes at the top. Stamens 16 in the staminate flower, inserted in 2 sets, with short filaments and sagittate anthers; stamens 8 in the fertile flower, generally abortive. Pistil consisting of a conical ovary which is pilose toward the top, surmounted by 4 slender styles bearing 2-lobed stigmas.

Fruit — A depressed-globose or somewhat obovate-oblong, glaucous, pale orange-colored and often red-checked berry, 1–1½ inches in diameter, subtended by the four, accrescent calyx-lobes, borne on a short, thick, woody stalk. Seeds 1–8, oblong, compressed, embedded in the juicy, astringent flesh which becomes sweet and yellowish brown as the fruit ripens in the late fall.

Winter characters — Twigs slender, astringent, pubescent or glabrous, orange-lenticellate, grayish or light brown becoming darker the second year. Terminal bud absent. Lateral buds ovate, acute, about ⅛ of an inch long, covered by 2 dark reddish brown or purplish scales. Mature bark thick, dark reddish brown to dark gray or nearly black, divided by deep fissures into small blocks which are scaly at the surface.

Habitat — Dry sandy soils in open woods, or on the deep moist soils of river bottoms, especially in the South.

Range — Connecticut westward to southern Iowa, south to Florida and Texas. Restricted in New York State to the vicinity of New York City. Zone A.

Uses — Wood hard, heavy, fine-textured, dark brown or nearly black with thick, paler sapwood. Used in the manufacture of shoe lasts, shuttles, sporting and athletic goods, etc. The fruit which is edible but very variable in its astringent qualities, is to be found in the markets of our southern cities in season.

White Ash

Fraxinus americana L.

1. A twig-tip showing staminate inflorescences and immature leaves x 1
2. A staminate flower, lateral view x 5
3. Portion of twig showing pistillate inflorescence x 1
4. A pistillate flower, lateral view x 5
5. A mature leaf x ½
6. Portion of fruit cluster x ½
7. Winter twig x ½

OLEACEAE

Fraxinus americana L.

White Ash

Habit — A valuable timber species attaining a height of 70–80 feet with a trunk diameter of 2–3 feet, under favorable conditions sometimes 120 feet in height with a trunk 5–6 feet in diameter. In the forest the trunk is tall, straight, and massive, and bears a narrow, reduced, pyramidal crown. When growing in the open the crown is broadly pyramidal or oblong and round-topped, and often extends nearly to the ground.

Leaves — Opposite, odd-pinnately compound, 8–15 inches long, borne on stout, grooved petioles, consisting of 5–11 stalked leaflets arranged, except for the terminal, in pairs along the rachis. Leaflets ovate to ovate-lanceolate, generally falcate, 3–5 inches long, attenuate at the apex, unequally cuneate or rounded at the base, obscurely crenulate-serrate, at maturity thick, dark green, glabrous and often somewhat lustrous above, pale white and glabrous or pubescent below.

Flowers — Appearing in May before the leaves, dioecious, the staminate in dense, purplish red clusters, the pistillate in rather open panicles. Calyx campanulate, inconspicuous and obscurely 4-lobed in the sterile flower, conspicuous and deeply 4-lobed in the fertile flower. Corolla lacking. Stamens 2 (occasionally 3), with large oblong-ovate, apiculate anthers and short filaments. Pistil consisting of an ovate ovary contracted above into an attenuate style bifurcated into stigmatic lobes.

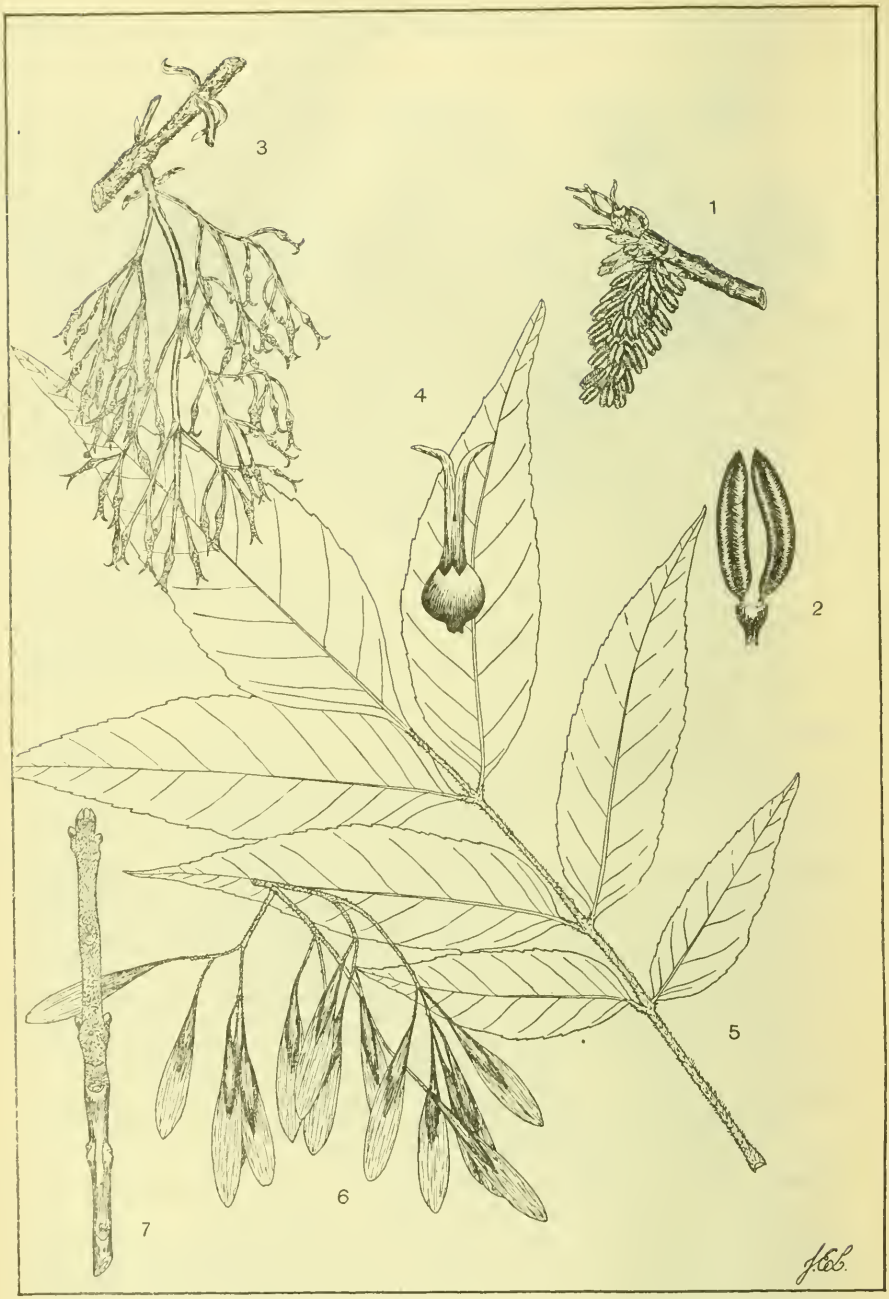
Fruit — An oblong or linear-spatulate, light brown samara, 1–2 inches long, consisting of a basal, terete, many-rayed, seed-bearing portion prolonged above into a wing which is pointed or emarginate at the apex and about ¼ of an inch in diameter. The samaras are borne in dense, drooping panicles 5–7 inches long which generally persist into the winter.

Winter characters — Twigs opposite, stout, flattened at the nodes, glabrous, lustrous or covered with a slight bloom, grayish brown, marked with scattered pale lenticels and prominent, semi-orbicular leaf-scars. Terminal bud hemi-spherical or broadly ovate and obtuse, rusty-brown to brownish black, scurfy or slightly downy, about ⅕ of an inch long. Visible scales 2–3 pairs. Lateral buds smaller, with blunter bud-scales. Superposed buds present on vigorous shoots. Mature bark rather thick, grayish brown, divided by deep narrow fissures into anastomosing ridges which are flattened, transversely checked, and scaly at the surface.

Habitat — Attains its best development in rich, moist, well-drained woods in admixture with other species. Common in rolling country in fields, pastures, and along fence rows and stream courses.

Range — Nova Scotia westward through southern Canada to Minnesota, south to Florida and eastern Texas. Zones A, B, **C**, and D.

Uses — A valuable timber species. Wood hard, heavy, strong, close-grained, tough, elastic, brown with wide, paler sapwood. Extensively used in the manufacture of tool handles, agricultural implements, furniture, automobiles, refrigerators, woodenware, novelties, etc. White Ash is of rapid growth, relatively immune from fungal diseases, and is to be recommended for reforestation in admixture with other species. Often planted as a shade and ornamental tree and hardy under adverse conditions.



Red Ash

Fraxinus pennsylvanica Marsh. [Fraxinus pubescens Lam.]

1. A twig-tip showing staminate inflorescence and unfolding leaf-buds x 1
2. A staminate flower, lateral view x 5
3. Portion of twig showing pistillate inflorescence x 1
4. A pistillate flower, lateral view x 5
5. A mature leaf x ½
6. Portion of fruit cluster x ½
7. Winter twig x ½

OLEACEAE

Fraxinus pennsylvanica Marsh. [Fraxinus pubescens Lam.]

Red Ash

Habit — A small or medium-sized tree generally 30–60 feet in height with a trunk diameter of 6–18 inches, under favorable conditions occasionally 70 feet in height and 3–4 feet in diameter. Bole similar to that of White Ash but more slender and sometimes buttressed at the base. Crown compact, irregular, consisting of numerous, upright branches.

Leaves — Opposite, odd-pinnately compound, 7–12 inches long, borne on stout, pubescent petioles, consisting of 7–9 stalked leaflets arranged, except for the terminal, in pairs along the pubescent rachis. Leaflets oblong-lanceolate to ovate, 3–5 inches long, attenuate at the apex, unequally cuneate at the base, obscurely serrate, at maturity thin, light yellow-green and glabrous above, pale silky-pubescent below.

Flowers — Appearing in May before or with the leaves, dioecious, the staminate in dense, purplish red clusters, the pistillate in open, greenish red panicles. Calyx cup-shaped, minute, obscurely toothed in the staminate flower, urceolate, more prominently lobed and closely appressed to the ovary in the pistillate flower. Corolla lacking. Stamens 2, with linear-oblong, apiculate anthers and short filaments. Pistil consisting of an ovate ovary prolonged above into an elongated style bifurcated at the apex into green stigmatic lobes.

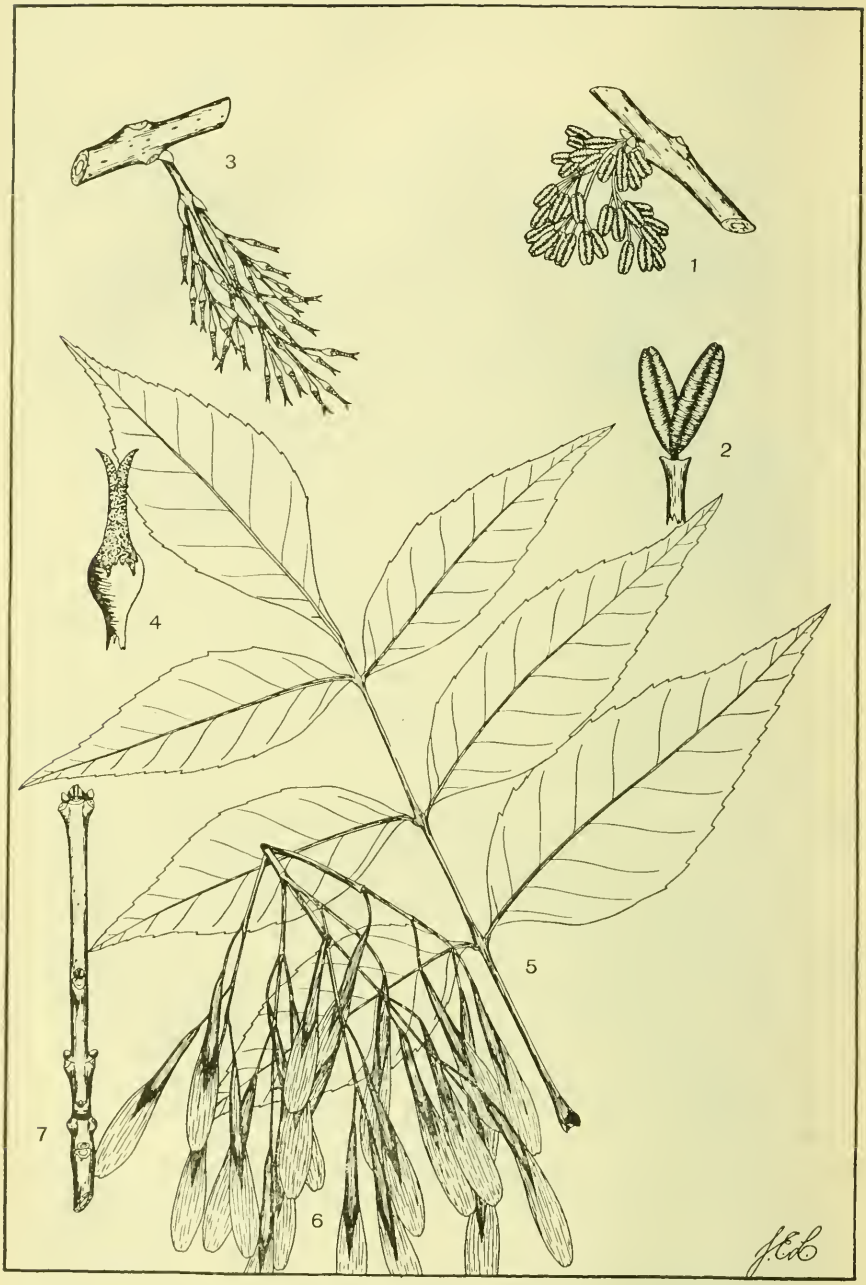
Fruit — An oblong-spatulate or spatulate, light brown samara, 1–2 inches long, consisting of a slender, basal, terete, many-rayed body prolonged above into a thin, decurrent wing with rounded or acute apex. Wing as long or longer than the body. Samaras borne in open, pubescent panicles which persist into the winter.

Winter characters — Twigs opposite, rather slender, flattened at the nodes, ashy-gray or pale reddish brown, generally densely velvety-pubescent and marked with conspicuous semi-circular leaf-scars. Terminal bud ovate, acute, rusty-brown and tomentose, smaller than that of White Ash. Lateral buds smaller, with rounded bud-scales. Visible scales 2 pairs. Mature bark thin, grayish brown, similar to that of White Ash but more shallowly furrowed.

Habitat — Swampy situations along sluggish rivers and lakes, often on lands inundated for a portion of each year, occasionally at higher elevations along stream courses.

Range — New Brunswick westward through southern Ontario to Minnesota, southward into the Gulf States. Zones A, B, and C.

Uses — Wood hard, heavy, medium strong, brash, light brown with thick, paler sapwood. Inferior to that of White Ash but used for the same purpose and often confounded with it in the trade. Occasionally planted for ornament but not superior to White Ash except on moist sites.



Green Ash

Fraxinus pennsylvanica, var. lanceolata (Borkh.) Sarg. [Fraxinus lanceolata Borkh.; Fraxinus viridis Michx. f.]

1. Portion of twig showing staminate inflorescence x 1
2. A staminate flower, lateral view x 5
3. Portion of twig showing pistillate inflorescence x 1
4. A pistillate flower, lateral view x 5
5. A mature leaf x ½
6. Portion of fruit cluster x ½
7. Winter twig x ½

OLEACEAE

Fraxinus pennsylvanica, var. lanceolata (Borkh.) Sarg. [Fraxinus lanceolata Borkh.; Fraxinus viridis Michx. f.]

Green Ash

Habit — Similar to that of Red Ash. A small or medium-sized tree 30–60 feet in height with a trunk diameter of 1–3 feet. In the open the crown is broad and round-topped, and extends to within 6–8 feet of the ground. Trees in bottom-land forests have slender boles and high, reduced crowns.

Leaves — Opposite, odd-pinnately compound, 8–12 inches long, borne on stout, glabrous petioles, consisting of 5–9 stalked leaflets arranged, except for the terminal, in pairs along the smooth rachis. Leaflets lanceolate or ovate-lanceolate, 3–5 inches long, attenuate at the apex, cuneate at the base, sharply serrate, at maturity thin, bright green, glabrous, and somewhat lustrous on both sides.

Flowers — Appearing in May before or with the leaves, dioecious, the staminate in purplish red clusters which are usually less dense than those of Red Ash, the pistillate in open, greenish red panicles. Calyx cup-shaped, obscurely toothed in the staminate flower, cup-shaped with jagged, more prominent lobes in the pistillate flower. Corolla lacking. Stamens 2, with linear-oblong, emarginate anthers and short filaments. Pistil consisting of an ovate ovary prolonged above into an elongated style bearing 2 stigmatic lobes at the apex.

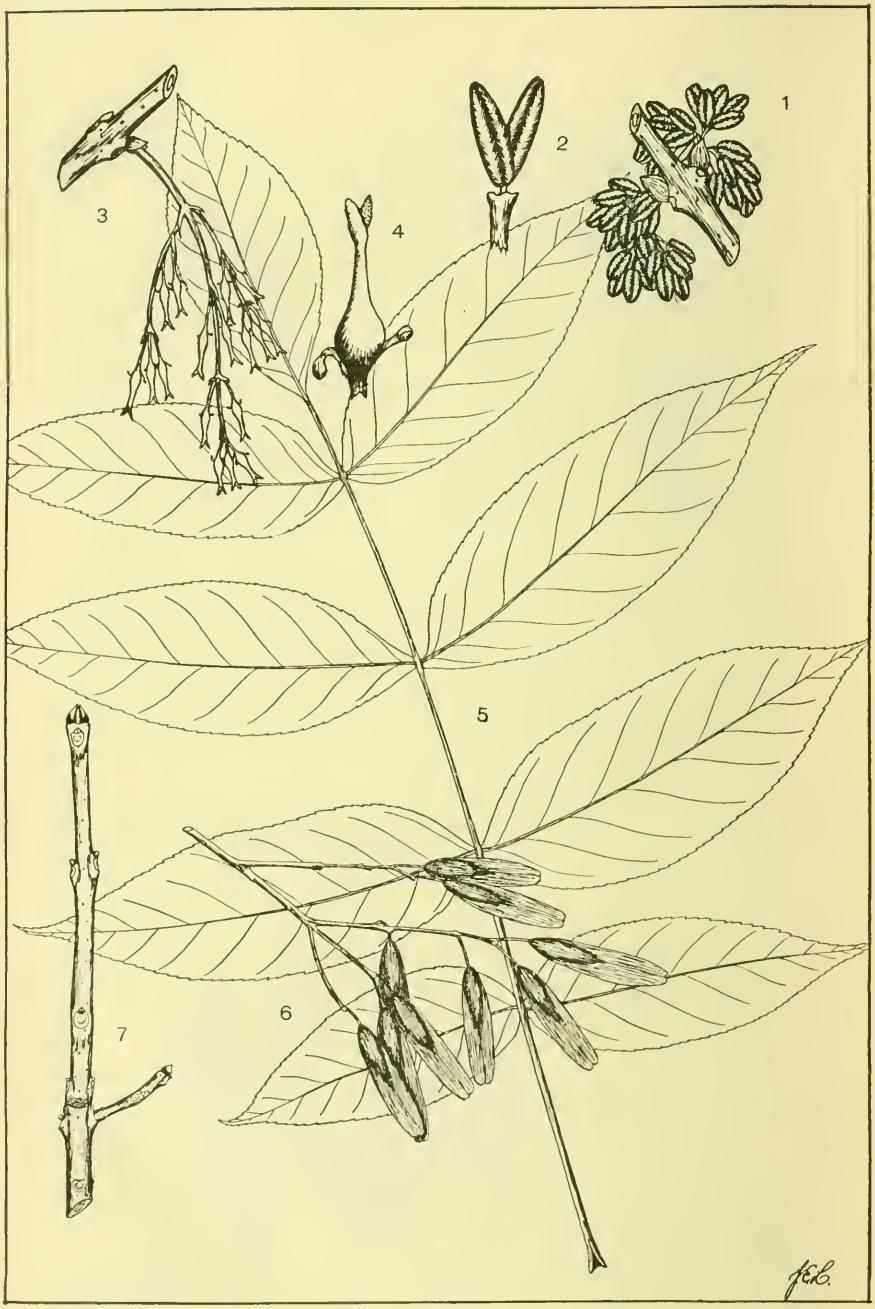
Fruit — Similar to that of Red Ash. An oblong-spatulate or spatulate, light brown samara, 1–2 inches long, with slender, terete, many-rayed body and terminal, decurrent wing. Fruiting panicles open, glabrous, persisting into the winter.

Winter characters — Twigs opposite, rather slender, spreading, flattened at the nodes, glabrous, ashy-gray, marked by scattered lenticels and semicircular leaf-scars. Terminal bud ovate, acute, flattened, rusty-tomentose, larger than the lateral buds. Visible scales 2 pairs. Mature bark thin, ashy-gray, with narrow fissures and narrow, anastomosing ridges.

Habitat — Similar to that of Red Ash. Damp situations along stream courses, lake shores and bottom-lands.

Range — New York westward through the Lake States to Saskatchewan and the eastern slopes of the Rocky Mountains, southward into the Gulf and Border states. Rare in the eastern part of its range but common in the Mississippi basin. Zones A, B and C.

Uses — Wood hard, heavy, strong, light brown with thick, paler sapwood. Used for the same purposes as that of White Ash and not distinguished in the trade. Extensively planted as a shade and ornamental tree throughout the Central States.



Black Ash

Fraxinus nigra Marsh. [Fraxinus sambucifolia Lam.]

1. Portion of twig showing staminate inflorescences x 1
2. A staminate flower, lateral view x 5
3. Portion of twig showing pistillate inflorescence x 1
4. A pistillate flower, lateral view x 5
5. A mature leaf x ½
6. Portion of fruit cluster x ½
7. Winter twig x ½

OLEACEAE

Fraxinus nigra Marsh. [Fraxinus sambucifolia Lam.]

Black Ash

Habit — Generally a medium-sized tree 40–70 feet in height with a trunk diameter of 1–1½ feet, under optimum conditions occasionally 80–90 feet tall with a diameter of 30 inches. Trunk tall, slender, bearing a high, narrow, shallow crown of numerous, ascending branches. In the open the tree is usually shorter with a round-topped crown which extends nearly to the ground.

Leaves — Opposite, odd-pinnately compound, 10–16 inches long, borne on stout pale petioles, consisting of 7–11 leaflets sessile and arranged in pairs along the rachis except for the stalked terminal one. Leaflets oblong-lanceolate, 3–5 inches long, acute at the apex, unequally cuneate or rounded at the base, remotely serrate, at maturity thin, dark green and glabrous above, paler and glabrous below aside from tufts of rufous hairs along the midrib.

Flowers — Appearing in May before the leaves, polygamous the staminate in dense, dark purplish clusters, the pistillate in elongate, rather open panicles. Perianth wanting. Stamens 2, with large, oblong, apiculate, dark purple anthers and short filaments. Pistil consisting of an ovate, glabrous ovary which gradually narrows above into a slender style bifurcated at the apex into broad, purple stigmas. Two stamens or staminodia are usually inserted below the pistil.

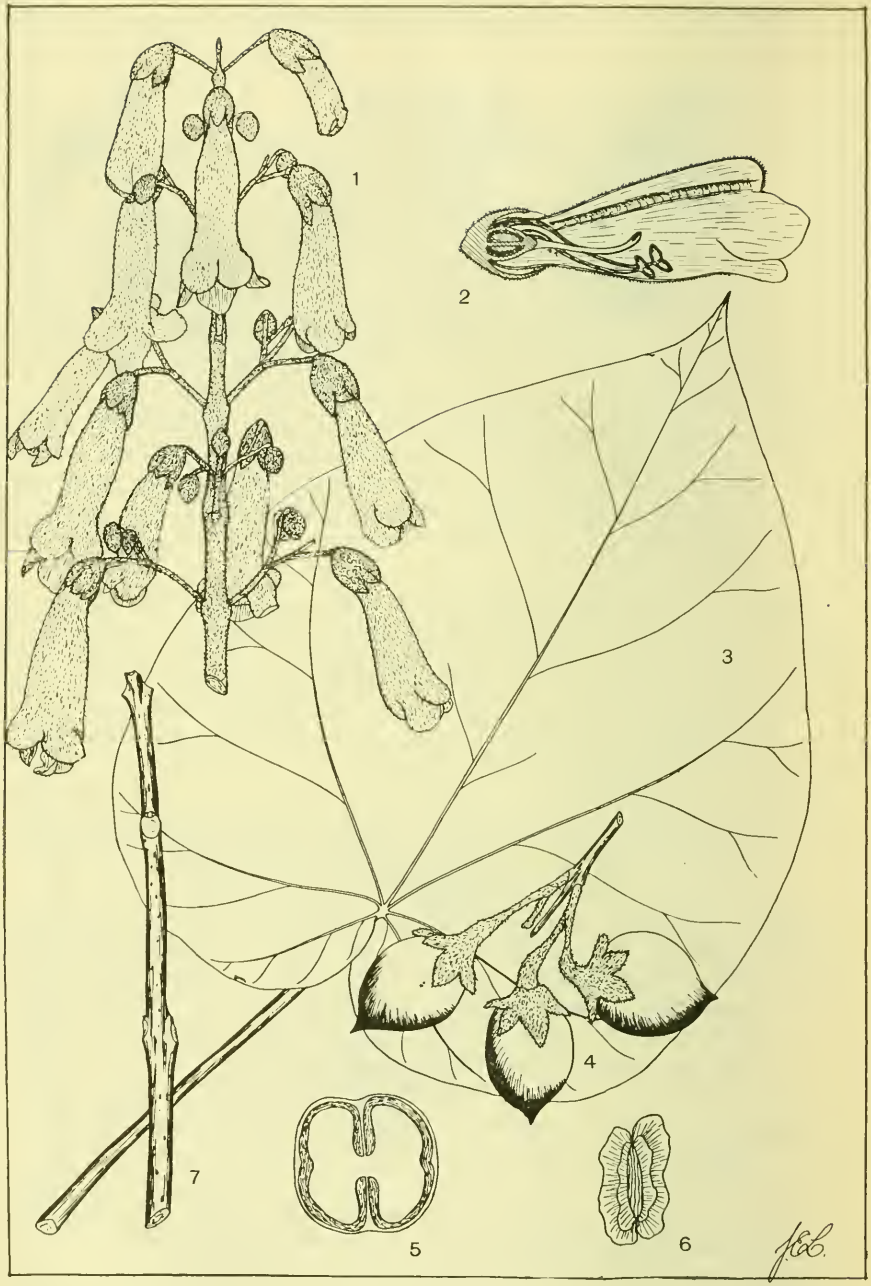
Fruit — A lanceolate-oblong or linear-oblong, light brown samara, 1–2 inches long, consisting of a basal terete or somewhat flattened, seed-bearing portion terminated above by a conspicuously notched wing. The samaras are borne in open panicles and mature in early autumn.

Winter characters — Twigs stout, glabrous, ashy-gray or pale orange, marked by conspicuous, scattered lenticels and large, suborbicular leaf-scars. Terminal bud ovate, acute, black, ¼–⅜ of an inch long. Lateral buds broadly ovate, acute, dark brownish black and slightly puberulous, much smaller than the terminal bud. Visible bud-scales 1–2 pairs. Mature bark thin, ashy-gray to nearly black, divided by shallow anastomosing fissures into narrow, scaly and somewhat corky ridges.

Habitat — In low, wet woods on bottom-lands or along sluggish rivers, at higher elevations along cold, mountain streams and in deep, poorly drained swamps.

Range — Southern Newfoundland westward through Canada and the northern border states to Manitoba and North Dakota, southward at higher elevations to Virginia and Arkansas. Zones A, B, C, and **D**.

Uses — Wood heavy, rather soft and weak, tough, coarse-grained, durable, dark brown with thin, paler sapwood. Because of its toughness the wood is used for hoops, chair bottoms, baskets, and for interior finish in houses. This species is occasionally grown ornamentally in swampy situations but is not to be recommended for this purpose.



Paulownia

Paulownia tomentosa (Thunb.) Steud. [Bignonia tomentosa Thung.; Paulownia imperialis Sieb. and Zuc.]

A portion of an inflorescence x ½
A flower, lateral sectional view x 1
A mature leaf x ½
Cluster of capsules x ½
5. Capsule, cross section, showing placentae and seeds x ¾
6. Winged seed, lateral view x 5
7. Winter twig x ½

SCROPHULARIACEAE

Paulownia tomentosa (Thunb.) Steud. [Bignonia tomentosa Thung.; Paulownia imperialis Sieb. and Zuc.]

Paulownia

Habit — A low, wide-spreading tree 20–40 feet in height with a trunk 1–3 feet in diameter. Bole short, dividing 5–8 feet above the ground into a few stout, spreading limbs which form a broad, flat-topped crown.

Leaves — Opposite, broadly ovate, 5–8 inches long or on vigorous shoots much larger, acuminate at the apex, cordate at the base, entire or 3-lobed, at maturity thick, dark green and nearly smooth above, paler and tomentose beneath, borne on stout, terete petioles 3–5 inches in length.

Flowers — Appearing in May before the leaves unfold, perfect, showy, fragrant, 1½–2 inches long, borne on stout, pubescent pedicels in terminal, upright panicles, 8–12 inches long. Calyx rusty-tomentose, deeply 5-cleft, persistent in fruit, the lobes short and acute. Corolla pale violet, pubescent without, irregular, the tube enlarged above and divided into 5 spreading, rounded, somewhat unequal lobes. Stamens 4, inserted on the corolla tube, included, didynamous, with slender filaments and wide-spreading anther-sacs. Pistil consisting of an ovate, 2-celled ovary surmounted by a filiform style somewhat thickened at the apex and stigmatic on the inner side.

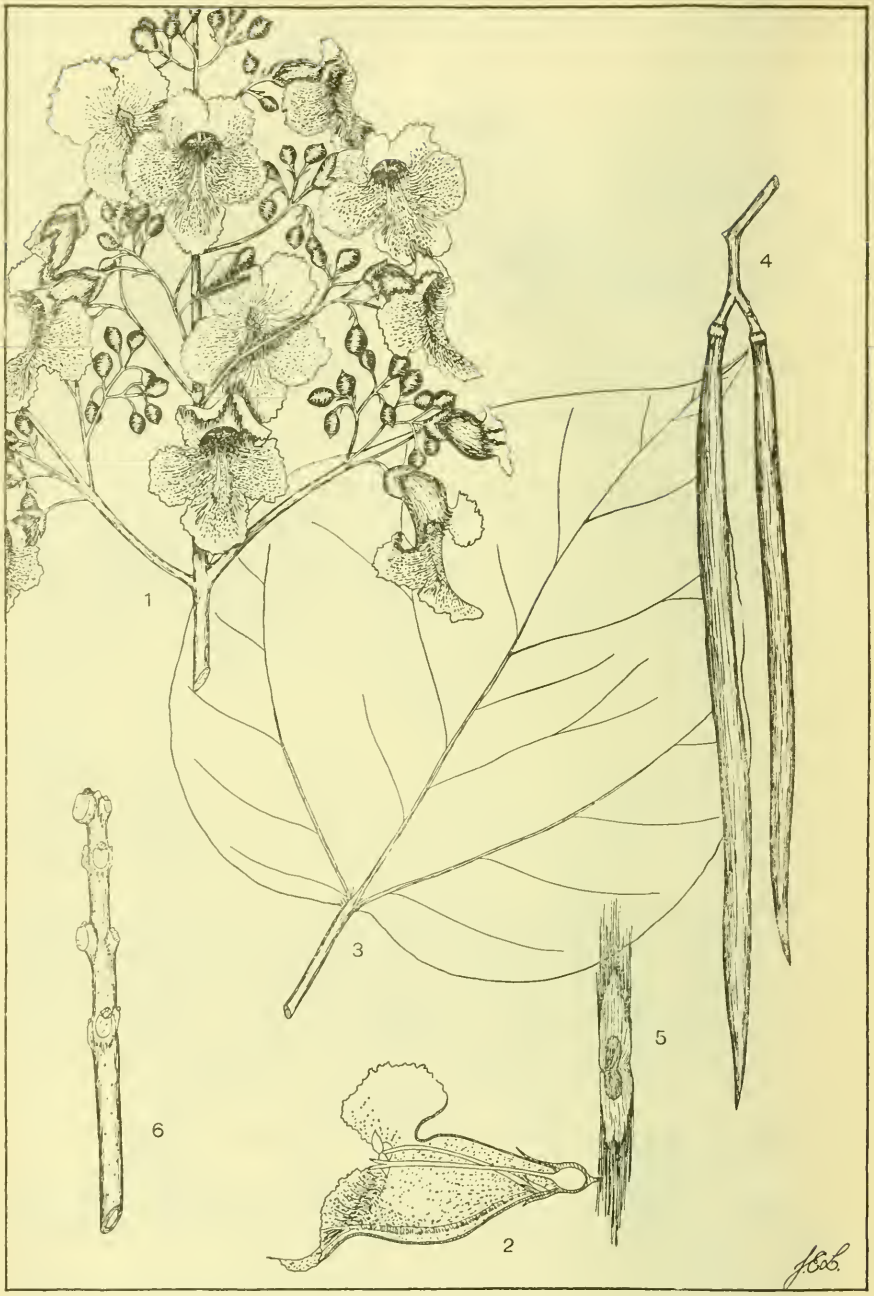
Fruit — A leathery, olive-brown or bronze, broadly ovoid, pointed capsule, 1–2 inches long, ¾–1 inch thick, shallowly longitudinally grooved on either side, subtended by the persistent calyx. At maturity the capsule opens by 2 loculicidal sutures to set free the numerous, small, lace-winged seeds. Opened capsules persist on the branches throughout the winter.

Winter characters — Twigs stout, glabrous, greenish brown, conspicuously marked with large, nearly orbicular, elevated leaf-scars and prominent lenticels, at length dark brown. Flower-buds ellipsoid, pubescent, nearly ½ of an inch long, preformed the previous season, borne in large, upright, paniculate clusters. Leaf-buds semi-circular, compressed, light brown, ⅛ of an inch long, the bud-scales spreading at the apex of the bud. Pith diaphragmed. Mature bark rather thick, dark grayish brown, mottled with shallow, grayish white, anastomosing fissures.

Habitat — In waste places about the habitations of man. Prefers deep, rich, moist soils.

Range — New York City southward to Florida and western Texas. Introduced from the Orient and now naturalized as far north as the latitude of New York City. Zone A.

Uses — Propagated in the eastern United States for its large, showy, fragrant flowers and large leaves which give a tropical effect. It will not flower beyond the latitude of New York City. Farther north it usually winter-kills to the ground each season but will continue to send up vigorous sprouts for a number of years. The soft, light wood is prized in the Orient.



Catalpa, Indian Bean

Catalpa bignonioides Walt. [Catalpa Catalpa (L.) Karst.]

1. A portion of an inflorescence x ½
2. A flower, lateral sectional view x ¾
3. A mature leaf x ½
4. Portion of fruit cluster x ½
5. Winged seed x ¾
6. Winter twig x ½

BIGNONIACEAE

Catalpa bignonioides Walt. [Catalpa Catalpa (L.) Karst.]

Catalpa, Indian Bean

Habit — In New York State generally a small tree 20–40 feet in height with a trunk 6–15 inches in diameter, farther south in its natural range occasionally 60 feet in height with a trunk diameter of 3–4 feet. Bole short, bearing a high, broad, symmetrical crown consisting of coarse, sparse branches and dense foliage.

Leaves — Opposite or 3 at a node, broadly ovate, 5–6 inches long, 4–5 inches wide, acute at the apex, rounded or cordate at the base, entire or sometimes laterally lobed, at maturity thin, light green and glabrous above, paler and pubescent below, borne on stout, terete petioles 5–6 inches in length.

Flowers — Appearing in June and early July after the leaves, perfect, showy, borne on slender pubescent pedicels in terminal, many-flowered, compact panicles 8–10 inches long. Calyx green or purplish, ½ of an inch long, cleft nearly to the base into 2 broadly ovate, entire lobes. Corolla white spotted with purple, nearly 2 inches long, with broad, campanulate, flat tube and spreading 5-lobed limb. Tube marked on the inner surface of the lower side with 2 rows of yellow blotches following 2 parallel ridges. Stamens 2, slightly exserted, with flattened, twisted filaments and oblong anthers borne vis-a-vis on either side of the stigma. Pistil consisting of a sessile, ovoid, 2-celled ovary, abruptly contracted into an elongate, filiform style bifurcated at the tip into stigmatic lobes which are exserted above the anthers.

Fruit — A linear, subterete, bright chestnut-brown capsule, 6–20 inches long, ¼–½ of an inch thick at the center and tapering toward each end. The capsules are borne in thick-stemmed, persistent panicles and remain closed and persist on the trees until spring, finally splitting into 2 concave valves before falling to set free the seeds. Seeds numerous, oblong, compressed, winged. The wings entirely surround the seed and are produced longitudinally into fringed ends.

Winter characters — Twigs stout, lustrous or somewhat glaucous, yellowish brown, marked by numerous, large lenticels and raised, circular leaf-scars, usually winter-killing at the tip in New York State. Terminal bud absent. Lateral buds minute, hemi-spherical, chestnut-brown, imbedded in the bark, with loosely imbricated bud-scales. Pith large, white, homogeneous or chambered at the nodes. Mature bark thin, light brown tinged with red, divided by shallow fissures into large, thin irregular scales.

Habitat — In New York State an "escape" in rich, moist soils about the habitations of man, in its natural range along stream courses and river banks, more rarely in drier situations.

Range — Western Georgia and Florida westward through Alabama and Mississippi. Now extensively propagated in all parts of the United States east of the Rocky Mountains and hardy as far north as central New England. Zones A and B.

Uses — Wood light, soft, not strong, coarse-grained, very durable in contact with the soil, light brown with narrow, nearly white sapwood. Used for railroad ties, fence posts, poles, etc. Extensively propagated for ornament in the parks and gardens of the eastern United States and in Europe.

Hardy Catalpa, Cigar Tree

Catalpa speciosa Warder.

1. A portion of an inflorescence x ½
2. A flower, lateral sectional view x ¾
3. A mature leaf x ½
4. Capsule x ½
5. Winged seed x ¾
6. Winter twig x ½

BIGNONIACEAE

Catalpa speciosa Warder.

Hardy Catalpa, Cigar Tree

Habit — In New York State generally a small or medium-sized tree 25–50 feet in height with a trunk 6–15 inches in diameter, farther west in the Ohio basin reaching a height of 100 feet with a trunk diameter of 4 feet. In the open the bole is short and bears a broad, spreading crown. Trees in the forest possess tall, straight trunks and reduced crowns.

Leaves — Opposite or 3 at a node, broadly ovate, 8–14 inches long, 6–8 inches wide, acuminate at the apex, rounded or cordate at the base, entire or with 2–3 lateral teeth, at maturity thick, firm, dark green above, paler and soft pubescent below, borne on stout, terete, pubescent petioles 4–6 inches in length.

Flowers — Appearing in June and early July after the leaves, perfect, showy, borne on slender, purple pedicels in terminal, open, few-flowered panicles 5–6 inches long. Calyx purple about ½ of an inch long, divided to the base into 2 ovate, apiculate divisions. Corolla white, spotted with purple, 2–2½ inches long, with broad, campanulate, flat tube and spreading, 5-lobed limb. Tube marked on the inner surface of the lower side with 2 rows of yellow blotches following 2 parallel ridges. Stamens 2, slightly exserted, with flattened, twisted filaments and oblong anthers borne vis-a-vis on either side of the stigma. Pistil consisting of a sessile, ovoid, 2-celled ovary abruptly contracted above into a slender glabrous style bearing 2 stigmatic lobes at the apex.

Fruit — A linear, subterete, dark brown capsule 8–20 inches long, ½–¾ of an inch thick at the center and tapering toward each end. The capsules are borne in thick-stemmed persistent panicles and remain closed and persist on the trees most of the winter, eventually splitting into 2 concave valves before falling to loose the seeds. Seeds numerous, oblong, compressed, winged. The wings entirely surround the seed and are produced longitudinally into fringed ends.

Winter characters — Twigs stout, smooth or somewhat downy, often covered with a slight bloom, reddish or yellowish brown, marked by numerous, conspicuous lenticels and raised, circular leaf-scars, usually winter-killing at the tip in New York State. Terminal bud absent. Lateral buds minute, hemispherical, chestnut-brown, imbedded in the bark. Bud-scales loosely imbricated. Pith large, white, homogeneous or chambered at the nodes. Mature bark, thin, reddish or grayish brown, broken by shallow fissures into longitudinal, flat ridges.

Habitat — Prefers rich, moist soils along stream courses and on bottom-lands. In New York State it occasionally becomes naturalized about door-yards and abandoned homes.

Range — Restricted in its natural range to central and southern Indiana and Illinois, eastern Missouri, northeastern Arkansas and western Kentucky and Tennessee. Now widely propagated for ornament and timber in the eastern United States. Zones A, B, and C.

Uses — Wood light, soft, not strong, coarse-grained, very durable in contact with the soil, light brown with thin, nearly white sapwood. Used for railroad ties, fence posts, poles, etc. A profitable tree to grow in sections where the climate is not too rigorous, but not to be recommended for planting in New York State. Propagated as an ornamental tree both here and abroad.

Nannyberry, Sheepsberry

Viburnum Lentago L.

1. A branch showing inflorescence and mature leaves x ½
2. A flower, lateral sectional view x 5
3. A fruit cluster x ½
4. Fruit, lateral sectional view x 2
5. Pit, lateral view x 2
6. Winter twig x ½

CAPRIFOLIACEAE

Viburnum Lentago L.

Nannyberry, Sheepsberry

Habit — Generally a shrub 10–15 feet in height, occasionally a bushy tree 20–30 feet in height with a trunk diameter of 6–10 inches. Trunk generally short, soon breaking up into slender, ascending, tortuous branches which form a wide, rounded top.

Leaves — Opposite, ovate to oval, 2½–5 inches long, abruptly acuminate at the apex, narrowed or rounded at the base, sharply and finely serrate on the margin, at maturity thick, bright green and lustrous above, yellowish green, dark punctate, and smooth below, borne on grooved, often winged petioles 1–1½ inches in length.

Flowers — Appearing in May and early June after the leaves in dense, sessile, many-flowered, several-rayed, terminal cymes 3–5 inches broad. Calyx-tube narrowly ovoid, adherent to the ovary, with 5 minute, persistent lobes. Corolla pale cream-colored or white, rotate, deeply 5-lobed. Stamens 5, exserted, inserted at the base of the corolla and alternate with its lobes, with long slender filaments and yellow anthers. Pistil consisting of an inferior, 1-celled ovary surmounted by a short, conic style bearing 3 stigmatic lobes at the apex.

Fruit — An oval, black or dark blue, thick-skinned, glaucous drupe, ⅖–½ of an inch long, borne on slender, reddish stalks in drooping clusters, ripening in September. Flesh juicy, sweet. Pit oval, flattened, granular.

Winter characters — Twigs slender, somewhat scurfy, light red, with scattered orange-colored lenticels, ill-smelling when broken. Terminal flower-buds ovate, long acuminate, about ¾ of an inch long, protected by a pair of opposite light red, scurfy-pubescent scales. Terminal-shoot buds lanceolate, otherwise similar to the flower-buds. Lateral buds lanceolate, appressed, much smaller than the terminal buds. Mature bark thin, reddish brown, divided by shallow fissures into small, irregular, scaly plates.

Habitat — In low, moist, fertile soils along stream courses and lake shores, occasionally in drier situations along fence rows.

Range — Quebec westward to Manitoba, southward to Georgia and Oklahoma. Zones A, **B**, and C.

Uses — Of no economic value except as an ornamental plant. Propagated in parks and private estates for its showy fragrant flowers, attractive foliage and showy, edible, autumnal fruit.

Black Haw, Stag Bush

Viburnum prunifolium L.

1. A twig showing inflorescence and immature leaves x ½
2. A flower, lateral sectional view x 4
3. A branch showing mature leaves and fruit x ½
4. Fruit, lateral sectional view x 1½
5. Pit, lateral view x 1½
6. Winter twig x ½

CAPRIFOLIACEAE

Viburnum prunifolium L.

Black Haw, Stag Bush

Habit — A shrub or small tree 15–25 feet in height with a trunk diameter of 3–6 inches, at its optimum range occasionally 35 feet in height with a trunk one foot in diameter. Trunk short, often crooked or inclined. Crown broad, round-topped, consisting of many rigid branches and spur-like branchlets.

Leaves — Opposite, oval or occasionally ovate or obovate, 1–3 inches long, obtuse or somewhat acute at the apex obtuse or rounded at the base, finely serrate, at maturity firm, dark green and glabrous above, paler and glabrous or with axillary tufts of rusty tomentum below, borne on grooved, generally tomentose petioles ½–⅔ of an inch long.

Flowers — Appearing in May after the leaves on slender pedicels in dense, many-flowered, sessile, terminal cymes 3–4 inches broad. Calyx-tube narrowly ovate, adherent to the ovary, with short rounded lobes. Corolla white, rotate, about ¼ of an inch in diameter, divided deeply into 5 oval lobes. Stamens 5, exserted, inserted at the base of the corolla and alternate with its lobes, with long slender filaments and yellow anthers. Pistil consisting of an inferior, 1-celled ovary surmounted by a thick, conic style terminated by a broad stigma.

Fruit — An oval or slightly obovate, dark blue or nearly black, glaucous drupe, about ¼ of an inch long, borne on slender, reddish stalks in drooping, few-fruited clusters, ripening in October. Flesh sweet and edible after the first autumnal frost. Pit oblong, compresser.

Winter characters — Twigs rather slender, smooth and often covered with a slight bloom, gray tinged with red, marked by orange-colored lenticels and lunate leaf-scars. Spine-like branch spurs usually very numerous. Terminal flower-buds ovate, obtuse, about ½ of an inch long, protected by a single pair of rusty pubescent scales. Terminal-shoot buds lanceolate, otherwise similar to the flower-buds. Lateral buds ovate-lanceolate, flattened, appressed to the twig, about ¼ of an inch long. Mature bark thin, reddish brown, divided by shallow fissures into irregular, warty scales.

Habitat — Rather dry situations on gravelly hills, along fences and hedge rows, and about the margins of woods, often forming extensive thickets on abandoned lands.

Range — Central New England and New York southward to Georgia and Arkansas. Zones A and **B**.

Uses — The Black Haw is used as an ornamental plant throughout the arboretums and parks of eastern United States and Europe. The bark of the roots has medicinal value.

CONSPECTUS

OF THE FAMILIES AND GENERA WHICH INCLUDE THE NATIVE AND NATURALIZED TREES OF NEW YORK STATE WITH

ANALYTICAL KEYS

LEADING TO THE SPECIES

CLASS I. GYMNOSPERMAE

NAKED-OVULED PLANTS

Flowering plants in which the seeds are borne naked upon the face of a scale and not inclosed in a ripened ovary or pericarp. The ovuliferous scales are usually aggregated into cones, the scales of which spread at maturity to permit the escape of the seeds. Gymnosperms are all woody and include trees, shrubs, and lianas. Formerly represented in large numbers during the Triassic and Jurassic periods of the Mesozoic, the group has waned in recent times to about four hundred and fifty species which are grouped in four orders, the *Cycadales, Coniferales, Gingkoales,* and *Gnetales.* Of these the *Coniferales* are most important because they include many forest trees which cover extensive tracts in temperate regions. The others are not represented among the native or naturalized trees of New York State.

CONIFERALES. PINE ORDER

1. Ovuliferous scales not forming a definite cone; seeds provided with a partially fleshy testa or an aril.....**Taxaceae**
2. Ovuliferous scales aggregrated into definite cones; seeds ripening dry **Pinaceae**

YEW FAMILY. TAXACEAE

Represented by eleven genera and some one hundred odd species, grouped in two tribes, the *Podocarpineae* and the *Taxineae.* The *Podocarpineae* are characteristic of the southern hemisphere and include valuable timber trees. The *Taxineae* are chiefly inhabitants of the northern hemisphere and are represented in New York State by but the one species, *Taxus canadensis* Marsh., the Ground Hemlock.

PINE FAMILY. PINACEAE

The Pine family of twenty-nine genera and approximately two hundred and forty-five species includes the dominant conifers.

Aside from a few shrubs they are all arborescent and world-wide in distribution but with a preponderance of forms in the north temperate zone. Certain species form almost pure stands of evergreen forest which cover extensive tracts.

Buds scaly. *Leaves* acicular, narrowly oblong, awl-shaped or scale-like, parallel-veined, solitary or fascicled, generally persistent. *Flowers* usually monoecious (dioecious in *Juniperus*), destitute of perianth, consisting of groups of sporophylls which are arranged spirally or cyclic in catkin-like clusters and bear ovules or pollen sacs on their faces; flowers usually subtended by an involucre of enlarged bud-scales; scales of male cone bearing 2 anther sacs; scales of ovulate cones bearing 2 or more ovules on the inner face. *Fruit* a woody or rarely a fleshy (*Juniperus*) cone consisting of indurated or fleshy scales; seeds often winged, copiously albuminous; embryo axile, with 2 or more cotyledons.

KEY TO THE GENERA

		PAGE
1. Leaves spirally arranged or borne in fascicles	2	
1. Leaves all opposite in pairs	6	
2. Leaves acicular, born in fascicles of 2–5	Pinus	345
2. Leaves linear or filiform, fascicled or scattered	3	
3. Leaves fascicled on short spurs and scattered spirally on the growth of the season; foliage deciduous	Larix	346
3. Leaves spirally arranged; foliage persistent	4	
4. Leaves, 4-sided, harsh and prickly to the touch, not prominently white-lined on the lower side	Picea	347
4. Leaves flattish, with soft feel, whitened along two prominent lines beneath	5	
5. Leaves jointed to persistent woody stalks; branchlets roughened by persistent leaf-bases	Tsuga	347
5. Leaves sessile, leaving round leaf-scars on falling; branchlets smooth	Abies	348
6. Sprays flattened; branchlets appearing in one plane	7	
6. Sprays not flattened; branchlets spreading	Juniperus	349
7. Leaves of 2 sorts; young twigs prominently flattened	Thuya	348
7. Leaves all alike; young twigs not prominently flattened	Chamaecyparis	349

THE PINES. Genus PINUS (Tourn.) L.

The genus *Pinus* is represented by evergreen trees and a few shrubs which are natives of the northern hemisphere and chiefly of temperate regions. Many species are of great economic importance as timber trees and cover extensive tracts, often in nearly pure stands. About eighty species are recognized of which thirty-four are indigenous to the United States. Six species are found within the boundaries of New York State.

Leaves evergreen, acicular, in fascicles of 2–5 which are borne on rudimentary branches in the axils of primary scale-leaves; fascicles arising from scaly buds, the scales of which lengthen and form a more or less persistent sheath at the base of the fascicle. *Flowers* vernal, monoecious; staminate flowers clustered at the base of the growth of the season, each flower subtended by an involucre of 3–6 scale-like bracts; stamens numerous, spirally arranged and

imbricated, the 2 pollen sacs terminated by a crest-like, nearly orbicular connective; ovulate flowers conical or cylindrical, consisting of spirally arranged, imbricated, ovuliferous scales borne in the axils of non-accrescent bracts; ovules 2, inverted. *Fruit* a pendant, woody cone maturing at the end of the second or rarely of the third season, consisting of the enlarged and indurated scales of the ovulate flower which are thickened and sometimes awned at the end; at maturity the cone-scales dry out and spread to liberate the 2 nut-like, winged seeds; cotyledons 3–12, linear.

KEY TO THE SPECIES

		PAGE
1. Leaves in fascicles of 5; cones cylindrical, 4–10 inches long	P. Strobus	77
1. Leaves in fascicles of 2–3; cones conical or ovate-conical, 1–3½ inches long	2	
2. Leaves in fascicles of 3	3	
2. Leaves in fascicles of 2	4	
3. Leaves somewhat rigid; cone-scales armed with stout prickles	P. rigida	79
3. Leaves flaccid; cone-scales armed with weak prickles	P. echinata	85
4. Leaves 3–6 inches long	5	
4. Leaves ¾–3 inches long	6	
5. Cone-scales unarmed; cones subterminal	P. resinosa	87
5. Cone-scales with slender prickles; cones lateral	P. echinata	85
6. Leaves ¾–1¼ inches long; cone-scales unarmed or at most with weak prickles	P. Banksiana	83
6. Leaves 1½–3 inches long; cone-scales armed with slender prickles	P. virginiana	81

The various species of pines fall into two groups, the *soft* and the *hard* pines, which are characterized as follows:

Soft Pines — Wood soft, light, even-textured, with thin, nearly white sapwood; fascicle-sheaths deciduous; leaves with one vascular bundle.

Hard Pines — Wood hard, heavy, coarse-grained, dark colored, often with thick sapwood; fascicle-sheaths persistent; leaves with two vascular bundles.

THE LARCHES OR TAMARACKS. Genus LARIX (Tourn.) Adans.

Larix is a genus of nine species of trees which are widely distributed over the northern and mountainous regions of the northern hemisphere in both the New and Old World. They produce hard, heavy, strong and durable wood which is valuable for structural purposes. Three species are indigenous to the United States, one of which, *Larix laricina*, occurs in New York State.

Leaves deciduous, narrowly linear, triangular or rarely 4-sided, rounded above, keeled and stomatiferous beneath, borne solitary in spirals on the leading shoots and in sheathless fascicles on short spurs on the older growth, turning yellow before falling in the autmun. *Flowers* solitary, terminal, monoecious, appearing with the leaves; staminate flowers oval, globose or oblong, yellow, sessile or stalked, consisting of numerous, spirally arranged

stamens, each with 2 pollen sacs and apiculate connective; ovulate flowers subglobose, consisting of a few or many, nearly orbicular, stalked, green, ovuliferous scales subtended by scarlet, projecting, mucronate bracts; ovules 2, inverted. *Fruit* an ovoid-oblong, woody, short-stalked, erect cone, maturing the first season; cone scales thin, concave, reduced to sterile bracts at the base of the cone; seeds nearly triangular, shorter than their wings; cotyledons 6.

THE SPRUCES. Genus PICEA Link.

The genus *Picea* consists of eighteen species confined wholly to the cooler parts of the north temperate and subarctic zones, often forming extensive forests on mountain slopes and plains. Seven species are native to North America, three of which occur in New York State.

Leaves persistent, linear, 4-sided, stomatiferous on all faces, spirally arranged and coming out from all sides of the twig, or occasionally appearing 2-ranked due to a twist in the petiole, articulated to persistent leaf-bases. *Flowers* terminal or in the axils of the upper leaves, monoecious, vernal; staminate flowers cylindrical, usually long-stalked and subtended at the base by accrescent bud-scales, consisting of numerous, spirally arranged stamens with 2 pollen sacs and connective produced distally into a broad, nearly circular, toothed crest; ovulate flowers oblong, oval, or cylindrical, the ovuliferous scales rounded or pointed and subtended by bracts; ovules 2, inverted. *Fruit* an ovoid or oblong-cylindrical, pendant, woody cone, maturing the first season, generally crowded on the uppermost branches; cone-scales thin, concave, unarmed, entirely concealing the bracts at maturity; seeds ovoid or oblong, acute at the base, much shorter than their wings; cotyledons 4–16.

KEY TO THE SPECIES

1. Branchlets glabrous and usually glaucous; cones oblong-cylindric..... 91
P. canadensis
1. Branchlets pubescent; cones ovate or ovate-oblong.....2
2. Foliage yellowish green or dark green; cones elongated-ovoid, reddish brown.....P. rubra 93
2. Foliage bluish green and glaucous; cones short-ovoid or sub-globose, dull ashy brown.....P. mariana 95

THE HEMLOCKS. Genus TSUGA (Endl.) Carr.

Tsuga is represented by seven species which are scattered over temperate North America, Japan, central and western China and the Himalayas. Four species occur in the United States, two eastern and two western forms respectively. The hemlocks are trees with pyramidal crown, horizontal or drooping branches and horizontal, flat sprays of foliage. The bark is rich in tannin.

Leaves persistent, linear, flat or angular, acute, obtuse or emarginate at the apex, stomatiferous in two white bands below or on both faces in *Tsuga Mertensiana*, spirally arranged but usually appearing 2-ranked by a twisting of the petioles, those on the upper side of the branchlet much shorter, abruptly

narrowed into short petioles which are articulated to woody, persistent bases. *Flowers* monoecious, solitary, vernal; staminate flowers subglobose, axillary, composed of numerous, spirally-arranged stamens with subglobose anthers and connective produced into an apiculate tip; ovulate flowers oblong to cylindric, erect, terminal; ovuliferous scales nearly orbicular, somewhat longer than the subtending bracts; ovules 2, inverted. *Fruit* an ovate-oblong to oblong, pendant, sessile or short-stalked, woody cone, maturing the first season and opening tardily during the winter; seeds ovate-oblong, acute at the base, smaller that the wings; cotyledons 3–6. *Tsuga canadensis* (L.) Carr. is found in New York State.

THE FIRS. Genus ABIES (Tourn.) Hill.

Under optimum development the firs are tall, pyramidal trees with slender, horizontal, wide-spreading branches in regular remote whorls of 4–5, and bark which is smooth when young and contains numerous resin-vesicles. The twenty-five species which are now recognized, are all natives of the northern hemisphere, chiefly of the cooler regions, and are scattered through North America, Japan, Asia, Europe, and northern Africa. Eight species are found in western United States while two occur in the Atlantic States.

Leaves persistent, linear, sessile, those on young trees and on lower sterile branches flattened and mostly grooved on the upper side (4-sided in *Abies magnifica*), rounded or emarginate at the apex, centrally grooved above, spirally arranged but generally appearing 2-ranked by a twist in their bases, stomatiferous only below, those on vigorous shoots and fertile branches crowded, incurved, more or less erect and quadrangular, obtuse or acute at the apex, sometimes stomatiferous above; leaves persist 8–10 years and in falling leave circular scars flush with the twig. *Branch-buds* usually resin-coated. *Flowers* axillary, monoecious, surrounded at the base by accrescent bud-scales; staminate flowers numerous on the lower side of branches above the middle of the tree, oval or oblong-cylindrical, composed of numerous, spirally arranged stamens with 2 anthers and connective ending in a knob; ovulate flowers erect on upper side of branchlet, usually confined to topmost branches, globose or oblong-cylindrical, consisting of spirally arranged ovuliferous scales, subtended but not overtopped by mucronate bracts; ovules 2, inverted. *Fruit* an ovoid or oblong-cylindrical, erect cone, maturing the first season; ovuliferous-scales numerous, broad, thin, subtended by a thin, membranous bract which projects in some species; at maturity the ovuliferous scale, bract and seed fall away from the upright, persistent cone-axis; seeds ovoid or oblong, winged; cotyledons 4–10. The genus is represented in New York State by *Abies balsamea* (L.), Mill., the Balsam Fir.

THE ARBOR-VITAES. Genus THUJA L.

The arbor-vitaes are resinous, evergreen trees with pyramidal crowns, flat, fan-shaped, 2-ranked sprays of foliage, soft, even-

garined, durable wood and thin fibrous bark. The genus is represented by four species and is confined to northern North America, Japan and eastern Asia. Two species are indigenous to North America, the western species, a valuable timber tree of the Pacific slope, the eastern species confined to the Atlantic States and Canada.

Leaves persistent, small, scale-like, decussate, acute, imbricated in 4-rows, stomatiferous on the back; on leading shoots, leaves rounded on the back and narrowed to long points; on lateral flattened shoots, lateral rows strongly keeled, much compressed and nearly covering the central rows. *Flowers* terminal, minute, monoecious, the two kinds generally on different branches; staminate flowers subglobose, composed of 4–6 decussate stamens, each consisting of a peltate connective and 4–6 anthers; ovulate flowers oblong or ovoid, consisting of 8–12 oblong, acute, decussate scales, the ovuliferous inner scales with 2 erect, bottle-shaped ovules. *Fruit* a small, oblong-ovoid cone which matures the first season, consisting of a few, thin, leathery scales, only the inner of which are fertile; seeds oblong, compressed, laterally winged; cotyledons 2. The genus is represented in New York State by *Thuja occidentalis* L.

THE COAST CEDARS. Genus CHAMAECYPARIS Spach.

The genus *Chamaecyparis* includes tall, evergreen trees with pyramidal crowns, spreading branches, fan-like sprays of foliage, and even-grained, durable wood. Six species have been described, confined to North America and Japan. Two of the North American species are found on the Pacific Coast. The Coast White Cedar, *Chamaecyparis thyoides* (L.) BSP., occurs along the Atlantic coast from Maine southward to Florida and the Gulf States.

Leaves persistent, very small, scale-like, ovate, acuminate, appressed or with spreading tips, decussate on vigorous shoots often acicular or linear and spreading. *Flowers* monoecious terminal, minute, the two sexes on different branches; staminate flowers oblong, consisting of numerous decussate stamens with ovate connective bearing 2 anther sacs; ovulate flowers subglobose, consisting of decussate, peltate scales, the fertile bearing 2–5 erect, bottle-shaped ovules. *Fruit* a small, erect, globose cone maturing the first season but persisting on the branchlets; cone-scales thick, peltate, centrally embossed, the fertile bearing 1–5 compressed, laterally winged seeds at the base; cotyledons 2.

THE JUNIPERS. Genus JUNIPERUS (Tourn.) L.

The Junipers are pungent-aromatic, evergreen trees or shrubs of the northern hemisphere with slender branches, soft, fine-grained and extremely durable wood and thin, shreddy bark. The

thirty-five representatives of this genus are widely distributed from the Arctic Circle to the West Indies, the highlands of Mexico, northern Africa and Japan. One species, *J. communis* L., is circumpolar in its range. Eleven species become arborescent within the boundaries of the United States. *Juniperus virginiana* L. is found in New York State.

Leaves trimorphic; one sort in whorls of 3, linear-subulate, acute, non-glandular, convex below, concave and stomatiferous above; a second kind scale-like, ovate, opposite or ternate, closely imbricated, appressed, adnate to the branch, glandular on the back on lateral shoots; the third sort free and awl-shaped, borne on vigorous shoots. *Flowers* dioecious, axillary or terminal, minute; staminate flowers solitary, oblong-ovate, consisting of numerous stamens decussate or in 3's with ovate or peltate connectives bearing 2–6 pollen sacs; ovulate flowers ovoid, bracteolate at the base, consisting of 2–6 opposite or ternate scales bearing minute, 2-ovuled, fertile scales on their inner face. *Fruit* a berry-like, succulent, blue-black, blue or red cone often with glaucous bloom, smooth or marked by the tips of the coalescing scales, containing 1–6 bony, wingless seeds; cones require 1–3 years to attain maturity; cotyledons 2–6.

CLASS II. ANGIOSPERMAE

PLANTS WITH OVULES ENCLOSED IN AN OVARY

Flowering plants in which the ovules are borne enclosed in an ovary which remains closed in fruit or dehisces to set free the seeds. This class includes the great bulk of the typical flowering plants which number approximately 125,000 species and are widely spread over the earth wherever plants grow. The essential feature of the group which separates it from Gymnosperms is the presence of the pistil in the flower in addition to stamens. Angiosperms are of more recent origin than Gymnosperms and comprise both herbaceous and woody types.

Angiosperms are divided into two sub-classes which are characterized, viz.:

Dicotyledons have (a) lateral cotyledons (generally two); (b) vascular bundles or tissue in a ring; (c) open venation; (d) 4- or 5-merous flowers.

Monocotyledons have (a) a single terminal cotyledon; (b) vascular bundles scattered in the stem; (c) closed venation; (d) 3-merous flowers.

Dicotyledons includes among their numbers herbs, shrubs and trees, and arborescent forms which are found in all regions from beyond the Arctic Circle to the Equator. Arborescent monocotyledons are confined to warm climates and are represented by Palms, Yuccas, etc., some of which grow in the warmer parts of the United States.

Subclass 1. DICOTYLEDONS

The *Dicotyledons* number about 100,000 species and comprise by far the greater part of the flowering plants. All of the arborescent plants of northern regions, with the exception of the coniferous trees, are included in this group which is interspersed with many herbaceous forms. *Dicotyledons* are more primitive than *Monocotyledons* and are thought to have been derived from ancestral forms of Gymnosperms during the lower Cretaceous.

Series 1. APETALAE

Dicotyledons in which the corolla is wanting; calyx may or may not be present.

WILLOW FAMILY. SALICACEAE

Trees or shrubs with brittle twigs, alternate, simple leaves, aments of dioecious flowers, soft light wood, and bitter bark. The

family includes but two genera, *Salix* comprising the willows and osiers, and *Populus,* the aspens and cottonwoods.

Leaves alternate, deciduous, simple, stipulate (stipules often caducous). *Flowers* dioecious, without perianth, borne solitary in the axils of scales in axillary aments which appear before the leaves in spring; staminate flowers consisting of 1–many stamens, inserted on a receptacle, subtended by a gland-like or cup-shaped disk; anthers 2-celled, longitudinally dehiscent; pistillate flowers consisting of a pistil with a 1-celled ovary surmounted by a short style and 2–4-lobed stigma; ovules numerous. *Fruit* a 1-celled, 2–4-valved, ovoid capsule bearing numerous, comose, minute, exalbuminous seeds.

KEY TO THE GENERA

PAGE

1. Scales of the ament entire; disk minute. glandular; buds with a single scale.... Salix 352
2. Scales of the ament laciniate; disk cup-shaped; buds with numerous scales.... Populus 353

THE WILLOWS. Genus SALIX (Tourn.) L.

The genus *Salix* includes about one hundred and seventy moisture-loving species of trees and shrubs, widely scattered throughout the northern hemisphere, a few forms occurring south of the equator. They thrive along stream banks and on moist bottom lands, and invade alpine summits and subarctic regions as scraggly, dwarfed shrubs. Approximately seventy species occur in North America, twenty-one of which are recognized as trees. A number of European species have been introduced for ornament and have become widely naturalized in eastern United States. Hybrids between European and native species are common.

Leaves alternate, simple, lanceolate to linear or obovate, short-petioled; stipules conspicuous oblique, serrate and persistent, or small and caducous. *Flowers* dioecious, borne in aments, with entire bracts and minute, gland-like, nectiferous disk; staminate flowers consisting of 1–12 stamens (generally 2 or 5) inserted at the base of the scale, with slender, mostly free filaments and small, oblong anthers; pistillate flowers consisting of a sessile or short-stalked, 1-celled ovary surmounted by a short style and 2-cleft or entire, more or less curved stigmas; ovules numerous. *Fruit* an acuminate capsule opening by 2 recurved valves, maturing in late spring or early summer; seeds minute, comose, exalbuminous. *Winter buds* covered with a single scale.

KEY TO THE SPECIES

PAGE

1. Stamens 1–2.....2
1. Stamens 3 or more (generally 5).....7
   2. Capsules glabrous.....3
   2. Capsules silky or tomentose.....5
3. Mature leaves with pale silky pubescence on both sides.... S. alba, var. vitellina 117
3. Mature leaves glabrous or essentially glabrate.....4
   4. Branches long and drooping; capsules sessile.....S. babylonica 119
   4. Branches not drooping; capsules short pedicelled.....S. fragilis 115

5. Filaments united; capsule sessile ..... S. purpurea 125
5. Filaments separate; capsule pedicelled 6
6. Mature leaves glabrous and glaucous beneath; pedicel of capsule shorter than the scale ..... S. discolor 121
6. Mature leaves pubescent and somewhat glaucous beneath; pedicel of capsule longer than the scale ..... S. rostrata 123
7. Leaves without petiolar glands; sterile aments elongated, slender cylindrical 8
7. Leaves with petiolar glands; sterile aments short cylindrical or ellipsoid-ovoid 9
8. Leaves pale or glaucous beneath; petioles generally $\frac{1}{2}$ of an inch or more in length ..... S. amygdaloides 109
8. Leaves green beneath; petioles less than $\frac{1}{2}$ of an inch in length .... S. nigra 107
9. Leaves ovate-lanceolate or lanceolate, attenuate-acuminate at the apex ..... S. lucida 113
9. Leaves ovate or oblong-ovate, acuminate at the apex ..... S. pentandra 111

THE POPLARS AND COTTONWOODS. Genus POPULUS (Tourn.) L.

Trees of rapid growth and large size, with scaly, generally resinous buds, long-petioled leaves, fugacious stipules, and bark which is at first smooth but eventually furrowed. Some twenty-five species have been described, natives of the northern hemisphere and ranging from the Arctic Circle to the tropics. Eleven species occur within the boundaries of the United States.

Leaves alternate, simple, ovate-lanceolate to orbicular or deltoid, long-petioled; stipules minute, fugacious. *Flowers* dioecious, borne in aments, each flower subtended by a fimbriate, caducous scale and cup-shaped, oblique disk; staminate flowers consisting of 4–60 stamens, with short free filaments and purplish anthers; pistillate flowers consisting of a sessile, 1-celled ovary surmounted by a short style and 2–4 entire or 4-lobed stigmas; ovules numerous. *Fruit* a subglobose or ovoid-oblong capsule subtended by the persistent disk, maturing in the late spring or early summer and dehiscing by 2–4 recurved valves; seeds minute, comose, exalbuminous. *Winter buds* covered with a number of scales, generally resinous.

KEY TO THE SPECIES PAGE

1. Petioles strongly flattened laterally 2
1. Petioles terete or channeled, not strongly flattened 4
2. Leaves deltoid ..... P. deltoides 123
2. Leaves broadly ovate or orbicular 3
3. Leaves round-ovate, coarsely dentate; buds scurfy-pubescent ..... P. grandidentata 115
3. Leaves ovate to orbicular, finely crenate-serrate; buds glabrous ..... P. tremuloides 113
4. Leaves densely white-tomentose beneath ..... P. alba 111
4. Leaves essentially glabrous when mature 5
5. Leaves densely white-tomentose when young; capsules slender-pedicelled .... P. heterophylla 117
5. Leaves not densely white-tomentose when young; capsules stout-pedicelled .. 6
6. Leaves broadly ovate, cordate or truncate at the base; petioles and lower surface of leaves pubescent ..... P. candicans 121
6. Leaves ovate-lanceolate to cordate-ovate; petioles and lower surface of leaves smooth ..... P. balsamifera 119

WALNUT FAMILY. JUGLANDACEAE

The walnut family consists of aromatic trees with watery juice, alternate, estipulate, odd-pinnately compound, deciduous leaves, monoecious flowers, and a fruit which is a nut. They are chiefly confined to the warmer parts of the north temperate zone. Two genera occur in North America, each of which is represented in New York State.

Leaves alternate, deciduous, odd-pinnate, estipulate, with long, grooved petioles; leaflets sessile or subsessile aside from the terminal, arranged in pairs along the rachis. *Flowers* monoecious, appearing after the leaves; staminate flowers in elongated drooping aments on the growth of the previous season or at the base of the growth of the season, each flower in the axil of a bract; calyx 3–6 lobed adnate to the subtending bract; pistillate flowers in terminal spikes or terminal and solitary, generally subtended by a bract and 2 bracteoles; calyx 3–5 lobed, adnate to the ovary; pistil consisting of a 1-celled or incompletely 3–4 celled, 1-ovuled ovary terminated by a short style and 2 plumose stigmas. *Fruit* a bony nut, indehiscent or dehiscent with a 4-valved exocarp; seed large, solitary, 2-lobed, oily, exalbuminous; cotyledons fleshy.

KEY TO THE GENERA

1. Staminate aments simple, sessile or short stalked; husk of the nut indehiscent; pith diaphragmed ..... Juglans 354
1. Staminate aments branched, long stalked; husk of the nut 4-valved; pith homogeneous ..... Carya 355

THE WALNUTS AND BUTTERNUTS. Genus JUGLANS L.

Trees with spreading crowns, stout branches, superposed buds, diaphragmed pith, and alternate, odd-pinnate leaves with sessile or nearly sessile leaflets. About ten species are known, four of which occur in the United States, two in the eastern states, one in the Pacific Coast region and one in the southwest.

Leaves alternate, odd-pinnately compound, consisting of 11–17 sessile or nearly sessile leaflets; leaflets oblong-lanceolate, acute at the apex, inequilateral at the base, finely serrate except at the base, arranged aside from the terminal in pairs along a stout pubescent petiole. *Flowers* monoecious, vernal, staminate flowers in drooping, cylindric aments 3–6 inches long borne on the twigs of the previous season; perianth 3–6 lobed; stamens 8–40 in 2 or more series; pistillate flowers in few-flowered spikes terminating the growth of the season; perianth adnate to the ovary, 4-lobed; petals 4, small, adnate to the ovary at the sinuses; pistil consisting of a usually 2-celled ovary, a short style and 2 plumose stigmas. *Fruit* a globose or ovoid nut with fibrous, somewhat fleshy, indehiscent exocarp and thick-walled, bony, rugose or sculptured, indehiscent endocarp; seed exalbuminous, deeply lobed, oily, edible.

KEY TO THE SPECIES

1. Leaflets 15-23; fruit subglobose, not viscid ..... J. nigra 143
1. Leaflets 11–17; fruit ovoid and pointed, viscid ..... J. cinerea 141

THE HICKORIES. Genus CARYA Nutt.

Trees with aromatic watery sap, tough flexuous branches, alternate odd-pinnately compound leaves, tough elastic wood and homogeneous pith. The genus is endemic to the temperate region of the eastern United States and includes twelve species, eleven of which occur within the boundaries of this country.

Leaves alternate, odd-pinnately compound; leaflets ovate or obovate, generally acuminate, inequilateral at the base, serrate, sessile or short-stalked aside from the terminal and arranged in pairs long a rachis. *Flowers* monoecious, vernal; staminate flowers in slender drooping aments borne in pedunculate clusters of 3 on the base of the growth of the season or near the summit of the growth of the preceding season; perianth adnate to the bract, 2–3 lobed or cleft; stamens 3–10; pistillate flowers in 2–10-flowered, terminal spikes; perianth unequally 4-lobed, adnate to the ovary; stigmas short-papillose. *Fruit* a subglobose, oblong, ovoid or pyriform nut with dehiscent, 4-valved exocarp and a bony endocarp which is 4-celled at the base and 2-celled at the apex. Seed variously lobed, exalbuminous, oily, generally edible.

KEY TO THE SPECIES

		PAGE
1.	Bud-scales few, valvate; lateral leaflets usually curved ..... C. cordiformis	155
1.	Bud-scales numerous, valvate; lateral leaflets slightly, if at all falcate 2	
2.	Husk of the fruit thick, splitting to the base 3	
2.	Husk of the fruit thin, usually not splitting to the base 5	
3.	Bark close and rough; foliage stellate pubescent ..... C. alba	149
3.	Bark shaggy, exfoliating in long, loose plates 4	
4.	Leaflets generally 3–5; twigs orange-lenticellate ..... C. laciniosa	147
4.	Leaflets generally 7–9; twigs pale lenticellate ..... C. ovata	145
5.	Fruit nearly globose; bark of old trunks exfoliating in long strips ..... C. microcarpa	151
5.	Fruit obovoid or pyriform; bark close, not exfoliating in long strips ..... C. glabra	153

BIRCH FAMILY. BETULACEAE

Trees or shrubs with watery juice, alternate, petioled, simple, stipulate leaves, monoecious or rarely dioecious flowers and a fruit which is a small winged or unwinged nut. The *Betulaceae* are indigenous to the cooler portions of the northern hemisphere and include 6 genera and approximately eighty species. Three genera are represented by arborescent forms in New York State.

Leaves alternate, deciduous, simple, stipulate (stipules generally fugacious), pinniveined. *Flowers* monecious, vernal, appearing before or with the leaves; staminate flowers in elongated pendulous lateral aments, borne in clusters of 1–6 in the axils of bracts; perianth present or wanting; stamens 2–20, erect, inserted on a receptacle, with short filaments and oblong anthers; pistillate flowers in short, spike-like or capitate aments, borne in clusters of 1–3 in the axils of bracts; perianth present or wanting; pistil consisting of a 2-celled ovary terminated by a 2-cleft style, the lobes stigmatic at the apex or on the inner surface; ovule solitary, pendulous. *Fruit* a small, mostly 1-celled,

1-seeded nut, winged in some genera; seed small, exalbuminous; cotyledons fleshy.

KEY TO THE GENERA

1. Staminate flowers solitary in the axils of ament-scales; scales of the pistillate ament deciduous; nutlet wingless....2
1. Staminate flowers 3–6 in the axils of ament-scales; scales of the pistillate ament persistent, forming a strobile; nutlet winged....Betula 357
2. Involucre of the fruit foliaceous, 3-cleft; staminate aments enclosed in buds during the winter....Carpinus 356
2. Involucre of the fruit saccate, enclosing the nutlet; staminate aments exposed during the winter....Ostrya 356

THE HOP-HORNBEAMS. Genus OSTRYA (Michx.) Scop.

A genus of wide distribution throughout the northern hemisphere and including trees with alternate simple leaves, slender terete branchlets, scaly bark, and heavy close-grained wood. Four species have been described, two of which are indigenous to North America. *Ostrya virginiana* (Mill.) K. Koch., the Hop-hornbeam, is widely distributed in the United States east of the Rocky Mountains. The other species is confined to a restricted area in the southwest.

Leaves alternate, simple, oblong-lanceolate to oval or obovate, acute or rounded at the apex, rounded at the base, short-petioled. *Flowers* monoecious, expanding before the leaves; staminate flowers in short-stalked or sessile, clustered aments which are preformed the preceding season near the tips of the branchlets, consisting of 3–4 stamens with short, bifurcated filaments terminating in hairy anthers, inserted on a receptacle at the base of a broadly ovate, acute, concave scale; pistillate flowers in erect, lax aments terminating short leafy branchlets, borne at the base of a narrowly ovate, foliaceous, ciliate scale which persists until mid-summer, each flower enclosed in a saccate involucre formed from the union of a bract and two bracteoloes; calyx adnate to the ovary; style short, bearing 2 filiform stigmas. *Fruit* a small, ovoid, compressed, acute nutlet enclosed in an enlarged, pale straw-colored, saccate involucre, the cluster resembling the fruit of the hop, hence the name Hop-hornbeam.

THE HORNBEAMS. Genus CARPINUS (Tourn.) L.

Carpinus includes about twelve species of small trees or shrubs scattered over the north temperate zone from Quebec to Central America in the New World and through Europe, Asia, China and Japan in the Old World. They are characterized by smooth gray bark, furrowed and fluted trunks, and a prominently ribbed nutlet subtended by a trilobed, foliaceous, involucral bract. But one species, *Carpinus caroliniana* Walt. is found in the United States.

Leaves alternate, simple, ovate, acute or acuminate, cordate or rounded at the base, petioled; stipules strap-shaped to oblong-obovate. *Flowers* monoecious, vernal; staminate flowers in pendant aments which appear from buds produced the previous season, naked, consisting of several stamens with bifurcated filaments terminated by anthers borne in the axils of broadly ovate, acute, nearly sessile scales; pistillate flowers in slender, few-flowered aments terminal on leafy branchlets of the year, in pairs at the base of an ovate, acute, leafy, deciduous scale, each pair subtended by a bract and two bractlets; calyx adnate to the 2-celled ovary; stigmas 2, subulate. *Fruit* a small, acute, compressed, longitudinally-ribbed nutlet, tipped with the calyx-lobes and attached at the base until maturity to a large, foliaceous, 3-lobed, pale green involucre formed by the union of the accrescent bract and bracteoles.

THE BIRCHES. Genus BETULA L.

The genus *Betula* is represented by some thirty odd species of aromatic trees and shrubs scattered through the subarctic and north temperate zones in Europe, Asia, and North America. Some are large ornamental trees with white or silvery, laminated, papery bark. Others are reduced to scraggly, nearly resupinate shrubs and are confined to subarctic regions or alpine summits. Thirteen species occur in North America, ten of which have become arborescent.

Leaves alternate, simple, serrate or dentate, petioled. *Flowers* monoecious, unfolding with or before the leaves, anemophilous; staminate flowers in pendulous, solitary or clustered, sessile aments which are preformed the previous season and remain erect and naked on the twigs during the winter, borne in groups of 3 under a peltate bract and two bracteoles, each flower consisting of 2 2-parted filaments terminating in anther sacs and accompanied by a calyx of a single sepal: pistillate flowers without perianth, borne in clusters of 3 subtended by a 3-lobed, persistent accrescent scale, the many closely-imbricated scales forming short, oblong or cylindrical, usually short-stalked aments which terminate short, lateral, 2-leaved branches; pistil consisting of a compressed sessile ovary terminated by 2 spreading persistent styles which are stigmatic at the apex. *Fruit* an erect, inclined or pendant, oblong or oblong-ovoid strobile consisting of thin, woody, 3-lobed, imbricated scales, each bearing 3 laterally-winged, compressed nutlets; at maturity the scales fall away from the persistent cone-axis, releasing the nutlets.

KEY TO THE SPECIES

1. Leaves with 9–11 pairs of lateral veins; strobiles oblong-ovoid; bark of branchlets aromatic 2
1. Leaves with 5–9 pairs of veins; strobiles cylindrical or oblong; bark of branchlets not aromatic 3
2. Leaves heart-shaped at the base; strobile-scales smooth; bark dark brown, close ..... B. lenta 161
2. Leaves cuneate or slightly heart-shaped at the base; strobile-scales pubescent; bark silvery-gray, exfoliating in thin layers ..... B. lutea 163
3. Leaves rhombic-ovate; strobiles oblong, ripening in May or June; bark light reddish brown, exfoliating in thin persistent scales ..... B. nigra 165

3. Leaves deltoid or ovate and rounded at the base; strobiles cylindrical, ripening in the autumn 4
4. Leaves triangular, taper pointed; lateral lobes of ament scales short and divergent ..... B. populifolia 167
4. Leaves ovate, acute; lateral lobes of ament scales ascending ..... B. alba, var. papyrifera 169

THE BEECH FAMILY. FAGACEAE

Trees and shrubs with watery juice, slender terete branchlets, alternate stalked stipulate leaves, and monoecious flowers. The *Fagaceae* number some four hundred odd species arranged in six genera and are of wide distribution, mainly in the northern hemisphere. Five genera are found in the United States of which one is of general distribution, two are confined to the eastern states, and the remaining two are found on the Pacific slope.

Leaves alternate, simple, pinniveined; stipules linear, caducous. *Flowers* monoecious, small; staminate flowers in aments or capitate; calyx 4–8 lobed; stamens 4–20 with slender filaments and elongated 2-celled anthers; pistillate flowers solitary or in few-flowered clusters or spikes subtended by a scaly, persistent involucre; calyx 4–8 lobed, adnate; pistil consisting of a 3–7 celled ovary surmounted by a like number of linear styles. *Fruit* a 1-seeded nut subtended or enveloped by a persistent, accrescent involucre; seed exalbuminous, with fleshy cotyledons.

KEY TO THE GENERA

PAGE

1. Staminate flowers capitate; nut trigonous ..... Fagus 358
1. Staminate flowers in slender aments: nut rounded 2
2. Pistillate flowers 2–5 in each involucre; involucre becoming a prickly burr in fruit ..... Castanea 359
2. Pistillate flowers 1 in each involucre; involucre forming a subtending cup in fruit ..... Quercus 359

THE BEECHES. Genus FAGUS (Tourn.) L.

A genus of about six species characterized by smooth gray bark, slender wiry branchlets, chestnut-brown lanceolate buds, and hard, close-grained wood. The beeches are widely distributed through Europe, Asia and eastern North America. But one species, *Fagus grandifolia* Ehrh. is found in the United States and this is confined to regions east of the Great Plains.

Leaves alternate, simple, firm, deciduous, strongly straight-veined, plicate in the bud, short-petioled; stipules linear-lanceolate. *Flowers* monoecious, expanding with or soon after the leaves; staminate flowers in capitate many-flowered drooping heads borne on long 2-bracted peduncles; pedicels short; calyx-tube campanulate, 4–8 lobed, greenish yellow; stamens 8–16, exserted, inserted on the calyx-tube; pistillate flowers in sessile or stalked clusters of 2–4 arising in the axils of the upper leaves, each subtended by numerous awl-shaped bracts, the lower of which are bright red and deciduous, the upper united to form a 4-lobed burr; calyx 4- or 5-lobed, villous, adnate to the

ovary; pistil consisting of a 3-celled trigonous ovary surmounted by 3 filiform, recurved styles which are longer than the involucre and stigmatic at the top. *Fruit* a woody, thick-walled, ovoid burr covered with stout recurved prickles, opening at maturity to set free the 2 (1–3) ovoid, trigonous, lustrous brown nuts; seed albuminous, oily, edible.

THE CHESTNUTS. Genus CASTANEA (Tourn.) Hill.

Trees or shrubs with astringent sap, terete twigs, furrowed bark, alternate straight-veined leaves, monoecious flowers appearing after the leaves, and a fruit which is a prickly burr enclosing one or more nuts. *Castanea* is wholly confined to the northern hemisphere and is widely distributed through eastern North America, southern Europe, northern Africa, Asia, and Japan. Four or five species have been described including the one American species, *Castanea dentata* (Marsh.) Borkh.

Leaves alternate, simple, deciduous, ovate to oblong-lanceolate, coarsely serrate with secondary veins running into the teeth, short-petioled; stipules linear-lanceolate to ovate, caducous. *Flowers* monoecious, ill-smelling, appearing in midsummer after the leaves; staminate flowers in 3–7-flowered cymes in the axils of minute ovate bracts, the clusters borne in elongated, interrupted, simple aments which arise from the axils of the inner bud-scales of the upper bud or from the axils of the lower leaves of the year; calyx-tube straw-colored, puberulous, deeply divided into 6 ovate, rounded segments; stamens 10–20, exserted, with filiform filaments and globose or ovoid anthers; pistillate flowers scattered or spicate at the base of the shorter, persistent androgynous aments from the axils of the upper leaves, sessile, solitary or 2–3 together and surrounded with an involucre of numerous acute green bracts, the whole subtended by a bract and 2 bracteoles; calyx urn-shaped, 6-lobed, adnate to the ovary; 6 staminodia present; pistil consisting of a 6-celled ovary surmounted by 6 linear, spreading, white styles which are hairy below and bear terminal stigmas. *Fruit* a densely-spiny burr, maturing in the autumn and dehiscing by 2–4 valves to expose an inner surface clothed with lustrous pubescence, and 1–3 ovate, acute chestnut-brown nuts which are pubescent toward the apex and marked at the base by a large, conspicuous, rounded scar; seed usually solitary, exalbuminous, sweet and edible; cotyledons fleshy.

THE OAKS. Genus QUERCUS (Tourn.) L.

This genus comprises nearly three hundred trees and shrubs widely spread in various habitats over the temperate regions of the northern hemisphere and the high mountains of the tropics. In the New World they range from Canada southward through Mexico and Central America to the mountains of Columbia and in the Old World through Europe and Asia to the Indian Archipelago, the Philippines and Japan. Fifty-odd species occur within the boundaries of the United States, most of which are arborescent.

Numbered among these are some of our best timber trees, producing hard and strong woods excellent for structural purposes, furniture, interior finish, tight cooperage, etc. A number of natural hybrids have been described.

Leaves alternate, simple, deciduous or persistent, entire, pinnately lobed or variously toothed, often very variable on the same tree; stipules scarious, caducous or occasionally pesistent. *Flowers* monoecious, appearing with or before the leaves; staminate flowers in clustered, drooping, interrupted aments arising from the axils of the leaves of the previous year, the axils of the inner scales of the terminal bud, or of the leaves of the year; calyx yellowish green, campanulate, 4–7 lobed or divided; stamens 4–12 with filiform exserted filaments and yellow anthers; pistillate flowers solitary or in few-flowered spikes from the axils of leaves of the year, each flower subtended by a bract and two bracteoles; calyx urn-shaped, adnate to the ovary, with short campanulate 6-lobed limb; pistil consisting of an incomplete, mostly 3-celled ovary which is nearly enclosed in an accrescent involucre of imbricated scales, surmounted by 3 short or elongated styles. *Fruit* an ovoid-oblong or subglobose 1-seeded nut (acorn) maturing in 1–2 years, subtended at the base and more or less enveloped in a woody cup (involucre) of imbricated, partly united scales; cotyledons fleshy, plano-convex and entire.

KEY TO THE SPECIES

		PAGE
1.	Acorns maturing at the end of the first season; shell of acorn glabrous on the inner surface; leaves and their lobes obtuse (rarely with teeth and then never bristle tipped), bark pale, often scaly (White Oaks)	2
1.	Acorns maturing at the end of the second season; shell of acorn tomentose on the inner surface; leaves with bristle-tipped lobes or entire; bark dark, furrowed (Black Oaks)	7
2.	Leaves pinnately lobed or lyrate-pinnatified	3
2.	Leaves coarsely sinuate-toothed	5
3.	Mature leaves glabrous beneath	Q. alba 175
3.	Mature leaves pubescent or tomentose beneath	4
4.	Mature leaves pubescent beneath; upper scales of the acorn-cup not awned	Q. stellata 177
4.	Mature leaves white tomentose beneath; upper scales of the acorn-cup long-awned	Q. macrocarpa 179
5.	Mature leaves hoary tomentose beneath; fruit long-stalked, the peduncle longer than the petioles	Q. bicolor 181
5.	Mature leaves pubescent beneath; fruit sessile or short-stalked	6
6.	Leaves with acute or pointed teeth; mature bark ashy-gray, shallowly fissured	Q. Muhlenbergii 183
6.	Leaves with somewhat rounded teeth; mature bark dark brown to black, deeply fissured	Q. Prinus 185
7.	Leaves pinnately lobed or pinnatifid	8
7.	Leaves entire or 3–5 lobed at the summit	12
8.	Longest lobes of the leaf about equaling the breadth of the middle portion of leaf	9
8.	Longest lobes of the leaf 2 or more times the breadth of the middle portion of the leaf	10
9.	Cup saucer-shaped	Q. rubra 187
9.	Cup turbinate	Q. rubra, var. ambigua 193
10.	Cup saucer-shaped	Q. palustris 189
10.	Cup turbinate	11
11.	Scales of the cup hoary, the upper loosely imbricated	Q. velutina 195
11.	Scales of the cup puberulous, the upper closely imbricated	Q. coccinea 191
12.	Mature leaves rusty-pubescent beneath; cup turbinate	Q. marilandica 197
12.	Mature leaves glabrous beneath; cup saucer-shaped	Q. phellos 199

ELM FAMILY. ULMACEAE

Trees or shrubs with watery juice, terete branchlets, alternate simple leaves, perfect or polygamous flowers, and a fruit which is a samara, nut, or drupe. The family includes thirteen genera and some one hundred and forty species, widely distributed throughout the temperate regions of the northern hemisphere. Five genera are represented within the boundaries of the United States, three by arborescent forms in the eastern and southern states.

Leaves alternate, deciduous, simple, serrate, pinniveined, petiolate, inequilateral at the base; stipules usually fugacious. *Flowers* small, perfect, monoecious or polygamous, clustered or the pistillate solitary; calyx-tube regular, 4–9-lobed or parted; petals lacking; stamens 4–6, exserted, with straight filaments and longitudinally dehiscent anthers; pistil consisting of a 1-celled, 1-ovuled ovary surmounted by 2 styles and stigmas. *Fruit* a samara, drupe or nut.

KEY TO THE GENERA

PAGE
1. Flowers perfect; fruit a samara ..... Ulmus 361
1. Flowers polygamo-monoecious; fruit a drupe ..... Celtis 362

THE ELMS. Genus ULMUS (Tourn.) L.

Trees or shrubs with scaly bark, alternate serrate inequilateral leaves, perfect flowers, a fruit which is a samara, and heavy tough wood. Some sixteen species are known which are widely distributed through the subarctic and temperate regions of the northern hemisphere, western North America excepted. Six native species occur in the United States, all confined to regions east of the Rocky Mountains, three of which extend into New York State.

Leaves alternate, deciduous, simple, simply or doubly serrate, with straight secondary veins; stipules scarious, caducous. *Bud-scales* several. *Flowers* on twigs of the previous season, vernal and appearing before the leaves or autumnal and arising from the axils of the leaves of the season, perfect, borne on bibracteolate pedicels in fascicles or racemes; calyx-tube campanulate, membranaceous, 4–9-lobed; stamens 5–6, exserted, with slender filaments and oblong anthers; pistil consisting of a sessile or stalked, compressed, 1-celled, 1-ovuled ovary surmounted by 2 divergent styles stigmatic on their inner faces. *Fruit* a flat, ovate or oblong, often oblique, sessile or stalked, 1-seeded samara, subtended at the base by the remnants of the calyx and tipped with the remnants of the styles; seed compressed, exalbuminous, in our forms germinating in early summer.

KEY TO THE SPECIES

PAGE
1. Leaves scabrous above; flowers nearly sessile; samara naked on the margin . . . U. fulva 201
1. Leaves smooth or nearly so above; flowers on slender, drooping pedicels; fruit ciliate on the margin 2

2. Flowers in racemose clusters; samara faces pubescent; winter buds prickly to the touch; branchlets often with corky wings.....U. racemosa 205
2. Flowers in short-stalked fascicles; samara faces smooth; winter buds acute but not prickly to the touch; branchlets without corky wings.....U. americana 203

THE HACKBERRIES. Genus CELTIS (Tourn.) L.

The genus *Celtis* includes some fifty or sixty species of trees and shrubs widely scattered throughout the temperate and tropical regions of the world. They resemble the elm in many respects but differ in having polygamous flowers and a drupaceous fruit. The American forms are very variable in the shape of the leaves and the number of species is as yet not definitely fixed. At least one arborescent form (*Celtis occidentalis* L.) occurs in New York State.

Leaves alternate, deciduous, simple, serrate, prominently 3–5 nerved; stipules membranous, caducous. *Flowers* small, axillary, polygamo-monoecious, pedicellate, appearing with the leaves on branchlets of the year; staminate flowers fascicled toward the base of the growth of the season, the pistillate solitary or 2–3 together in the upper leaf-axils; calyx deeply 4–5 lobed or parted, greenish yellow, deciduous; stamens 4–5 with incurved subulate filaments which straighten abruptly at anthesis in the staminate flowers and catapult the pollen, but remain curved and shorter in the perfect flowers; pistil consisting of an ovoid, sessile ovary crowned by the 2 reflexed styles which are stigmatic on the inner faces. *Fruit* an ovoid or globose drupe with thick firm skin, thin flesh, and thick-walled, bony, rugose or smooth nutlets.

MULBERRY FAMILY. MORACEAE

A large family of trees, shrubs, and herbs, numbering over nine hundred species distributed in fifty-five genera, scattered over the tropical and temperate regions of the world. Three genera are represented by indigenous arborescent forms in North America while a fourth includes the naturalized Paper Mulberry, *Broussonetia papyrifera* (L.) Vent.

Sap generally milky. *Buds* scaly or naked. *Leaves* alternate, simple, petiolate; stipules enclosing the leaf in the bud. *Flowers* monoecious or dioecious, small, arising from the axils of caducous bud scales or from the lower leaves of the season, borne in ament-like spikes or heads which are borne without or within a receptacle; calyx of staminate flower 3–4 lobed or parted; stamens 1–4, inserted on the calyx; calyx of pistillate flower deeply 3–5 lobed; pistil consisting of 1–2-celled ovary surmounted by 1–2 styles and stigmas. *Fruit* drupaceous, enclosed in the fleshy calyx, multiple.

KEY TO THE GENERA

		PAGE
1. Staminate and pistillate flowers in ament-like spikes	Morus	363
1. Staminate flowers racemose; pistillate flowers capitate	2	
2. Leaves crenate-serrate or variously lobed, fruit 2–5–1 inch in diameter; twigs unarmed	Broussonetia	363
2. Leaves entire; fruit 3–5 inches in diameter; twigs armed	Maclura	364

THE MULBERRIES. Genus MORUS (Tourn.) L.

Morus is represented by six or seven species of trees with milky sap, scattered over the tropical and temperate zones of both the eastern and western hemispheres. Two species are found in the United States, the Red Mulberry with a wide distribution east of the great plains, and a southwestern form. The White Mulberry, a native of northern China and Japan, was introduced in an attempt to establish the silk industry and has become widely naturalized in the eastern states.

Leaves alternate, deciduous, simple, entire, serrate or variously lobed, 3-nerved at the base; stipules enclosing the leaf in the bud, lanceolate, caducous. *Flowers* monoecious or dioecious, the staminate and pistillate on different branches of the same plant or on different plants, vernal, in peduculate clusters from the axils of caducous bud-scales or the lower leaves of the year; staminate flowers in elongated cylindrical spikes; calyx with 4 rounded lobes; stamens 4, inserted opposite the lobes and inflexed in the bud, straightening elastically at anthesis and becoming exserted; rudimentary ovary present; pistillate flowers sessile, in short compact spikes; calyx 4-parted with thickened ovate or obovate valvate lobes (outer pair longest) enveloping the flattened ovoid ovary; styles 2, white, spreading. *Fruit* a multiple, fleshy syncarp resembling a blackberry, consisting of many druplets each enclosed in the succulent, thickened, colored calyx and crowned with the style remnants; seed penduluous, albuminous.

KEY TO THE SPECIES

		PAGE
1. Leaves glabrous beneath or sparingly pubescent on the veins; fruit white or pinkish white	M. alba	215
1. Leaves soft pubescent beneath; fruit reddish purple	M. rubra	213

THE PAPER MULBERRY. Genus BROUSSONETIA L'Hér.

Broussonetia includes three or four species of trees or shrubs with milky juice, alternate or opposite entire or lobed leaves, capitate clusters of pistillate flowers, and fibrous inner bark. One species, *Broussonetia papyrifera* (L.) Vent., has became widely naturalized in the temperate portions of the United States.

Leaves alternate, deciduous, simple, entire, serrate or variously 1–5-lobed, 3-nerved at the base, long-petioled. *Flowers* dioecious, vernal, the staminate in oblong, cylindrical, nodding, ament-like spikes; the pistillate in capitate clusters; staminate flowers with 4-parted calyx; stamens 4, inserted opposite the lobes, exserted at anthesis; rudimentary ovary present; pistillate flowers

with a tubular calyx, stalked ovary and laterally attached filamentous style. *Fruit* a globular head consisting of many red drupes each exserted above a fleshy red stipe and perianth.

THE OSAGE ORANGE. Genus MACLURA Nutt.

A genus endemic to the United States and consisting of a single species, *Maclura pomifera* (Raf.) Schw., originally confined to a restricted area in southern Missouri, Oklahoma and northeastern Texas but now widely naturalized in eastern United States. A medium-sized tree with rounded crown, spinescent twigs, milky juice, and deeply furrowed orange-brown bark.

Leaves alternate, deciduous, simple, ovate to oblong-lanceolate, rounded or sub-cordate at the base, entire, at maturity dark green and lustrous above, duller and conspicuously reticulate-veined beneath, turning bright yellow in the autumn; petioles long, terete; stipules small, caducous. *Branchlets* with short lateral spurs or armed with sharp axillary spines. *Flowers* dioecious, appearing after the leaves; staminate flowers in long-stalked, sub-globose heads from the axils of crowded leaves on short lateral spurs, slender-pedicelled; calyx 4-lobed; stamens 4, opposite the lobes of the calyx, inflexed in the bud but straightening elastically at anthesis and becoming exserted; pistillate flowers in dense, sessile or short-stalked heads arising in the axils of the leaves of the season; calyx ovate, divided to the base into thick, oblong, concave lobes which closely invest the ovary, the outer pair the larger; pistil consisting of an ovate, compressed, green, 1-ovuled ovary surmounted by an elongate, filiform style. *Fruit* a globose, yellowish green, mammillate aggregate consisting of many oblong, compressed druplets and the thickened, much elongated perianths, the whole saturated with milky juice; seed oblong, compressed, light chestnut-brown, exalbuminous.

Series 2. POLYPETALAE

Dicotyledons in which both calyx and corolla are present (or without corolla in *Liquidambar*, certain species of *Acer*, etc.), the corolla consisting of separate petals.

MAGNOLIA FAMILY. MAGNOLIACEAE

A family of ten genera and some seventy species, widely distributed in temperate and tropical regions. They are trees or shrubs with watery juice, bitter aromatic bark, alternate leaves, showy flowers, and thick rootlets. Four genera are represented in North America, two by arborescent forms in eastern United States.

Bud-scales stipular, enclosing the leaves in the bud. Leaves alternate, pinniveined, petioled, conduplicate in the bud. *Flowers* large, showy, terminal, perfect, pedunculate, enclosed in the bud in a caducous stipular sheath;

sepals and petals generally of the same color, imbricated in the bud, hypogynous, deciduous; stamens numerous, imbricated, inserted on the elongated receptacle; pistils numerous, similarly arranged, inserted above the stamens. *Fruit* an aggregate head of 1–2-seeded follicles or samaras forming a naked, cone-like structure, the axis marked below by the scars of the deciduous stamens and perianth-lobes.

KEY TO THE GENERA

PAGE

1. Leaves entire or auriculate at the base; anthers introrse; carpels fleshy at maturity, dehiscent, persistent ..... Magnolia 365
1. Leaves 4–6 lobed; anthers extrose; carpels dry at maturity, indehiscent, deciduous ..... Liriodendron 365

THE MAGNOLIAS. Genus MAGNOLIA L.

Trees or shrubs with smooth or scaly bark, branchlets encircled by stipular scars, stipular membranous bud scales, and showy terminal flowers. The genus includes some twenty species, natives of eastern North America, Mexico and Asia. Seven species are indigenous to the eastern states, two of which occur in New York State.

Leaves alternate, deciduous or persistent, simple, entire or auriculate at the base, often minutely punctate. *Flowers* perfect, hypogynous, terminal, showy, appearing before or after the leaves; sepals 3, spreading or reflexed; petals 6–12, concave, erect or spreading, arranged in series of 3; stamens numerous, with short filaments and linear anthers, early deciduous; pistils numerous, inserted above the stamens on the receptacle, consisting of a 1-celled, 2-ovuled, sessile ovary and a short recurved style. *Fruit* an aggregate, scarlet or rusty-brown cone consisting of coalesced, drupaceous, persistent follicles which dehisce at maturity on the dorsal suture; seeds scarlet, drupe-like, compressed, albuminous, suspended from the follicles by thin cords of uncoiled spiral vessels.

KEY TO THE SPECIES

PAGE

1. Leaves oval or broadly lanceolate, thick, subpersistent, 4–6 inches long ..... M. virginiana 217
1. Leaves ovate to oblong-oval, thin, deciduous, 4–10 inches long ..... M. acuminata 219

THE TULIP TREES. Genus LIRIODENDRON L.

Trees with deeply furrowed brown bark, branchlets encircled by stipular scars, stipular membranous bud-scales, lobed truncate leaves, and a strobilus of samaroids. The genus includes but two species, one widely distributed in the eastern United States, the other in central China.

Leaves alternate, deciduous, simple truncate, heart-shaped or somewhat cuneate at the base, truncate at the apex by a broad shallow sinus, sinuately 4- (rarely 6-) lobed. *Flowers* perfect, hypogynous, terminal, showy, appearing after the leaves; sepals 3, greenish white, concave, erect or spreading, early deciduous; petals 6 in 2 series, erect, early deciduous; stamens numerous, with filiform filament and linear, 2-celled anthers; pistils numerous, inserted

above the stamens on the receptacle and imbricated in a spindle-shaped column, with winged style and small stigma. *Fruit* a narrow, erect, pale brown cone consisting of the many flattened samara-like, indehiscent, 4-ribbed carpels which fall away from the axis at maturity; seeds 1–2, suspended, albuminous.

CUSTARD-APPLE FAMILY. ANONACEAE

A large tropical family widely distributed throughout the tropical and subtropical regions of both the New and Old World, consisting of over five hundred species grouped in fifty-one genera. But two genera are represented in North America, one in the eastern United States, the other confined to southern Florida and the West Indies.

Sap watery. *Branchlets* terete, with conspicuous leaf-scars. *Leaves* alternate, entire, pinniveined, estipulate, petioled. *Flowers* perfect, solitary, axillary or opposite the leaves; sepals 3, valvate in the bud; petals 6, in two series; stamens numerous on the elevated rounded receptacle, with short distinct filaments and 2-celled anthers which are prolonged above into a broad, fleshy, truncate connective; pistils few, inserted on the summit of the receptacle; ovary 1-celled, 1-many ovuled. *Fruit* baccate or compound, generally fleshy, formed of the ripened pericarp of one or several pistils; seeds inclosed in an aril, large, smooth, brown and lustrous, with ruminate albumen.

THE PAPAWS. Genus ASIMINA Adans.

A genus of six or seven species including small trees or shrubs confined to eastern North America. But one species, *Asimina triloba* Dunal. becomes arborescent and occurs as far north as New York State. The remaining forms are low shrubs of the South Atlantic and Gulf states.

Twigs ill-scented when bruised. *Buds* minute, cinero-pubescent. *Leaves* membranaceous, entire, petioled, deciduous. *Flowers* mostly from the axils of the leaves of the previous season, nodding, pedunculate, purplish, ill-smelling; sepals green, ovate, concave, smaller than the petals, early deciduous; petals 6, ovate or obovate-oblong, reticulately veined, accrescent, the 3 exterior alternate with the sepals and spreading, the inner series erect and much smaller; stamens numerous, linear-cuneate, densely packed on the receptacle; anther cells separate on the fleshy connective; pistils few on the summit of the receptacle, projecting above the stamens; ovary 1-celled; style oblong, slightly curved, stigmatic on the margin; ovules 4–20, horizontal, 2-ranked on the ventral suture. *Fruit* an oval or oblong, smooth berry; seeds ovate, compressed, marked at the base with a large hilum.

LAUREL FAMILY. LAURACEAE

A large chiefly tropical family consisting of aromatic trees and shrubs grouped in about forty genera and nine hundred species,

of wide distribution throughout the warmer parts of the world. Six genera are represented in North America, two of which include only shrubby forms; three of the remaining arborescent genera are found in the Atlantic States while the fourth occurs on the Pacific Slope.

Leaves alternate or rarely opposite, rather thick, pellucid-punctate, estipulate. *Flowers* small regular, yellowish green, perfect, unisexual or polygamous, generally fragrant; calyx 6-lobed, the lobes in 2 series, imbricated in the bud; corolla lacking; stamens 9 or 12, inserted at the base of the calyx in 3 or 4 sets of 3, distinct, the inner set sterile; anthers 4-celled, superposed in pairs, opening by uplifted lids; ovary 1-celled, 1-ovuled; stigma discoid or capitate. *Fruit* a 1-seeded berry or drupe; seed with erect embryo, the cotyledons fleshy.

THE SASSAFRAS. Genus SASSAFRAS Nees.

Aromatic trees with deeply furrowed bark, smooth green pithy mucilaginous twigs, and entire or lobed, alternate leaves. Two species have been described, one a native of the temperate portion of eastern North America, the other of China.

Leaves alternate, membranaceous, deciduous, ovate or obovate, entire and acute or 1–3-lobed at the apex with broadly ovate, oblique lobes separated by deep broad sinuses, cuneate at the base, conspicuously, reticulate and arcuate-veined, at maturity dark green, glabrous and impressed-veined above, paler beneath. *Flowers* vernal, appearing with the leaves, usually dioecious borne on slender pedicels in lax, pilose, umbelled, few-flowered racemes in the axils of accrescent, obovate bud-scales; calyx yellowish green, divided nearly to the base into 6 narrowly obovate, subequal, spreading lobes; stamens 9, inserted in 3 series on the thickened margin of the calyx-tube; filaments elongated, compressed, light yellow, those of the inner series equipped with two orange-colored, stalked glands; anthers oblong, orange-colored, those of the fertile flowers generally reduced to staminodia; pistil consisting of an ovoid, green, glabrous ovary terminated by a long style and capitate stigma. *Fruit* a globose-oblong, dark blue, lustrous berry, borne upright in the red, accrescent, obscurely-lobed calyx and enlarged end of the pedicel; flesh thin; seeds brown, smooth and pointed.

WITCH HAZEL FAMILY. HAMAMELIDACEAE

Trees or shrubs with watery juice, slender terete branchlets, naked or scaly buds, alternate leaves, and fibrous roots. Some eighteen genera and thirty-five species are included, natives of eastern North America, southern and eastern Asia, the Malay Archipelago, Madagascar and South Africa. Three genera are represented in North America, two by arborescent forms.

Leaves alternate, simple, stipulate, petiolate, deciduous. *Flowers* perfect or unisexual; calyx 4-parted the tube adherent to the ovary, or none; petals

4 or none; stamens 4–8 or indefinite, with 2-celled introrse anthers; pistil consisting of a 2-celled ovary inserted in the bottom of the receptacle; crowned with 2 subulate styles stigmatic on the inner face. *Fruit* a woody, 2-beaked capsule, dehiscent at the summit; seeds 1 or several, albuminous, with straight embryo.

THE SWEET GUM. Genus LIQUIDAMBAR L.

Large timber trees with balsamic juices, scaly bark, terete and often winged pithy branchlets, star-shaped leaves and fibrous roots. Four species are included in the genus, one of which is indigenous to the United States.

Leaves alternate, deciduous, simple, nearly orbicular, serrate, deeply 5–7 palmately-lobed, borne on long petioles; stipules lanceolate, caducous. *Flowers* monoecious (or rarely perfect), the staminate in terminal, racemose, subglobose, capitate clusters each subtended by 4 caducous bracts, the pistillate in solitary long-stalked globular heads from the axils of the upper leaves; stamens numerous, interspersed with minute scales, with oblong anthers and filiform filaments; pistillate flowers surrounded by long-awned scales; calyx obconic, short-limbed, bearing 4 stamens or staminodia at the summit; pistil consisting of a partly inferior ovary terminated by two elongated, subulate, recurving styles. *Fruit* a globose, spiny, woody head consisting of many united capsules, each tipped with the 2 hardened, incurved, beak-like, elongated styles and dehiscing by two valves at the summit; seeds 1–2, compressed, angulate, winged; sterile seeds numerous, much smaller, resembling sawdust.

PLANE-TREE FAMILY. PLATANACEAE

A monogeneric family consisting of trees with watery juice, zigzag branches, subpetiolar buds, alternate stipulate leaves, and bark which exfoliates in large irregular scales from the trunk and larger branches. The sole genus consists of six or seven species confined to North and Central America, eastern Europe, and southwestern Asia. Three species are found in the United States, one widely distributed in the eastern states, a second on the Pacific Coast, and a third in the southwest. *Platanus orientalis* L. from the Old World, is widely grown in the United States as a street and shade tree.

Leaves alternate, simple, broadly ovate, cordate, cuneate, or truncate at the base, palmately 3–7-lobed and veined, the lobes entire, dentate, or coarsely sinuate-toothed; petioles long, abruptly enlarged and enclosing the buds at the base; stipules large, foliaceous and sheathing the branchlet on sterile shoots, thin, scarious and caducous on flowering shoots; when young the branchlets, leaf-blades, petioles and stipules are covered with stellate hairs. *Flowers* monoecious, minute, appearing with the unfolding of the leaves in unisexual, pedunculate, globose heads; staminate head dark red, axillary; sepals 3–6, scale-like, slightly united at the base; petals 3–6, cuneiform, about twice as long as the sepals; stamens 3–6, opposite the sepals, with

short filaments and elongate clavate anthers crowned with a pilose, truncate, connective; pistillate heads green tinged with red, solitary and terminal or in terminal spicate clusters, the lateral heads then embracing the peduncle at maturity; sepals 3–6, rounded; petals 3–6, acute, longer than the sepals; staminodia present; pistils 3–6, superior subtended at the base with persistent straight hairs, with long curved styles stigmatic on the ventral side. *Fruit* a subgobose head, consisting of many clavate, crustaceous 1-seeded achenes tipped with the persistent styles and subtended at the base with bristly hairs; seed oblong, albuminous.

THE PLANE TREES. Genus PLATANUS (Tourn.) L.

For distribution and characters of the genus, see description of the family.

ROSE FAMILY. ROSACEAE

Trees, shrubs and a few herbs numbering upwards of fifteen hundred species, grouped in about ninety genera. Rosaceous plants are widely distributed throughout the temperate regions of the world and include many of our important fruit trees such as the Apple and the Pear. Ten genera are represented by arborescent species within the United States.

Sap watery. *Branchlets* terete. *Buds* scaly *Leaves* alternate or rarely opposite, simple or compound, deciduous or persistent, stipulate. *Flowers* perfect, generally showy; calyx-tube 5-lobed; petals 5 and separate, or wanting; stamens numerous, distinct, inserted with the petals on a disk lining the calyx-tube; anthers small, 2-celled, longitudinally dehiscent; pistils 1-many, distinct or united and combined with the calyx-tube; ovules 1–2 in each cell. *Fruit* various.

KEY TO THE GENERA

		PAGE
1. Ovary inferior, 2–5 celled, adnate to the enlarged calyx-tube (or receptacle); fruit a pome	2	
1. Ovary superior, 1-celled; fruit a drupe	Prunus	371
2. Mature carpels papery or soft-cartilaginous at maturity	3	
2. Mature carpels hard and bony at maturity	Crataegus	371
3. Cells of the ovary as many as the styles, without false partial partitions	Pyrus	3 9
3. Cells of the ovary twice as many as the styles, with false partial partitions	Amelanchier	370

THE APPLES AND PEARS. Genus PYRUS (Tourn.) L.

Small or medium sized trees of the northern hemisphere, chiefly of the Old World. Some forty species are included, of which five are native to North America, four in the eastern states and one on the Pacific Slope. In addition several introduced species have become widely naturalized.

Leaves alternate, deciduous, simple or compound, petioled; stipules free from the petioles, caducous. *Flowers* white or pink, in simple or compound cymes, terminal on short, often spinescent spurs or on leafy shoots; calyx-tube urn-shaped, the 5 lobes imbricated in the bud and generally persistent; petals 5, rounded, short-clawed, spreading; stamens numerous, the filaments persisting in the fruit; pistil consisting of a compound ovary of 3–5 cells adnate to the calyx-tube terminated by a like number of styles which are free or united at the base and bear terminal stigmas; ovules 2 to each cell. *Fruit* a large fleshy or small berry-like pome formed by the enlarged ovary and adnate calyx and crowned with the vestigial stamen-filaments and calyx-lobes; seeds erect, lustrous brown, exalbuminous.

KEY TO THE SPECIES

		PAGE
1.	Leaves simple; pome large, subglobose or pyriform	2
1.	Leaves compound; pome small and berry-like, globose	4
2.	Leaves coriaceous and lustrous above; fruit pyriform, the flesh with grit cells	P. communis 231
2.	Leaves membranous and dull above; fruit subglobose, the flesh without grit cells	3
3.	Leaves ovate, glabrous at maturity; petioles and fruit-stalks elongated and slender; branches spinescent	P. coronaria 233
3.	Leaves ovate-oval, pubescent or woolly beneath; petioles and fruit-stalks short and stout; branches not spinescent	P. Malus 235
4.	Leaflets lanceolate, taper-pointed, glabrous above; fruit $\frac{1}{4}$ of an inch or less in diameter	P. americana 237
4.	Leaflets narrowly oblong, obtuse, more or less pubescent on both sides; fruit more than $\frac{1}{4}$ of an inch in diameter	P. Aucuparia 239

THE SERVICE BERRIES. Genus AMELANCHIER Medic.

The genus *Amelanchier* includes trees and shrubs with slender unarmed branches, lanceolate buds covered with closely imbricated scales, simple petioled leaves and racemose or rarely solitary flowers. The thirty or forty species are widely distributed throughout the north temperate regions of both hemispheres. In addition to the shrubby forms there are at least three arborescent species indigenous to North America, two in the eastern states and the third in the Rocky Mountain and Pacific Coast region.

Leaves alternate, deciduous, simple, entire or serrate, petioled; stipules linear, caducous. *Flowers* borne on slender bibracteolate pedicels in erect or nodding racemes or rarely solitary, appearing with the leaves; calyx-tube campanulate or urceolate, adnate to the ovary, with 5 lanceolate, reflexed, persistent lobes; petals 5, white, oblong-obovate, spatulate or ligulate, with short claws; stamens numerous, inserted with the petals on the rim of the calyx-tube, with subulate filaments and oblong anthers; pistil consisting of a 5-celled but falsely 10-celled ovary terminated by 2–5 styles which are connate below and bear terminal truncate stigmas; ovules erect, 2 in each cell. *Fruit* a small berry-like, globose pome maturing in our species in early summer, purplish or blue when ripe, crowned with the calyx-lobes and persistent stamen-filaments; flesh sweet, rather juicy, carpels membranaceous; seeds 5–10, oblong, compressed, exalbuminous.

KEY TO THE SPECIES PAGE

1. Leaves densely white-tomentose when young, at length becoming green; pedicels of fruit 2/5–1 inch long.....A. canadensis 241
1. Leaves essentially glabrous from the first; pedicels of fruit 1 1/5–2 inches long A. laevis 241

THE THORN-APPLES. Genus CRATAEGUS L.

Low, wide-spreading trees or shrubs with usually dark or gray scaly bark, rigid terete more or less zigzag branches often armed with stiff sharp thorns, alternate simple leaves, showy flowers, and pomaceous fruit. The genus attains its best development in eastern North America where many puzzling and intergrading forms have been described. In New York State alone over two hundred species are said to occur although the validity of some of these is open to question. Undoubtedly several hundred species will be found to be authentic, the bulk of which are found in eastern United States, with scattered forms in the Rocky Mountains, on the Pacific Coast, in Japan and Eurasia.

Leaves alternate, deciduous, simple, serrate and sometimes variously lobed, petioled; stipules caducous or foliaceous on vigorous shoots. *Flowers* perfect, regular, showy, borne in simple or compound corymbs terminating short leafy branchlets, the lowermost pedicels of a cluster often from the axils of the uppermost leaves; calyx-tube obconic, adnate to the ovary, the 5 lobes acute, reflexed and generally persistent; petals 5, white or pinkish, spreading, inserted on the throat of the calyx, early deciduous; stamens variable in the same species, normally 5 and alternate with the petals, but varying in multiples of 5 up to 25; filaments subulate, incurved, often persistent on the fruit; anthers pale yellow to white or from pink to dark rose and purple; pistil consisting of a 1–5 celled inferior ovary crowned with a like number of styles and stigmas; ovules 1–2 in each cell. *Fruit* a small, short-globose, oblong or pyriform pome, varying in color chiefly from red to yellow, containing 1–5 bony nutlets, each with a single upright seed.

THE PLUMS AND CHERRIES. Genus PRUNUS (Tourn.) L.

Trees or shrubs with bitter astringent properties, slender branchlets, scaly buds, alternate simple leaves, showy flowers and drupaceous usually edible fruits. Many contain prussic acid and exude a gum from the bark when wounded. The species of *Prunus* number about one hundred and twenty forms which are widely distributed throughout the temperate and tropical regions of the northern hemisphere. Some thirty species occur in the United States, eighteen of which are arborescent. In addition a number of species from the Old World have become naturalized.

Leaves alternate, deciduous or persistent, simple, serrate or entire, petioled, the petioles often glandular; stipules small, caducous. *Winter buds* scaly, the

inner scales accrescent. *Flowers* perfect, regular, showy, borne in axillary umbels or corymbs or in terminal or axillary racemes; calyx-tube inferior, 5-lobed, the lobes imbricated in the bud; petals 5, white, spreading, inserted with the numerous stamens on the calyx-tube; filaments filiform, free, bearing oval 2-celled anthers; pistil solitary, consisting of a simple 1-celled ovary terminated by an elongated style and capitate stigma. Fruit a 1-seeded drupe; flesh thick and pulpy or dry and thin; pit bony, compressed, smooth, rugose or pitted; seed solitary, pale brown, exalbuminous; cotyledons fleshy.

KEY TO THE SPECIES

1. Ovary glabrous; pit smooth or shallowly sculptured....2
1. Ovary velvety-tomentose....P. Persica 265
2. Flowers in racemes terminating leafy branches....3
2. Flowers umbellate or corymbose....4
3. Leaves oblong, rather thick, crenate-serrulate with incurved teeth....P. serotina 245
3. Leaves chiefly obovate, thin, sharply serrate, the teeth somewhat spreading....P. virginiana 247
4. Flowers in axillary umbels appearing before or with the leaves....5
4. Flowers in terminal corymbs appearing after the leaves....P. Mahaleb 253
5. Leaves conduplicate in the bud; fruit without ventral groove; stone globose or subglobose....6
5. Leaves convolute in the bud; fruit usually with a ventral groove; stone compressed....8
6. Leaves ovate, oval or obovate; petals $\frac{1}{3}$–$\frac{2}{3}$ of an inch long....7
6. Leaves oblong-lanceolate; petals less than $\frac{1}{3}$ of an inch long....P. pennsylvanica 249
7. Leaves membranous, pubescent beneath at least on the veins; fruit generally sweet; inner accrescent scales of flower-buds ligulate and spreading at blossom time....P. avium 255
7. Leaves semicoriaceous, glabrous; fruit sour; inner accrescent scales of flower-buds not ligulate, ascending at blossom time....P. Cerasus 257
8. Leaves ovate to obovate; fruit more than $\frac{1}{2}$ of an inch in diameter....9
8. Leaves oblanceolate to narrowly obovate; fruit $\frac{1}{2}$ of an inch or less in diameter....P. instititia 251
9. Umbels several flowered....10
9. Umbels 1–2 flowered....P. domestica 263
10. Leaves crenulate-serrate; calyx-lobes glandular-serrate....P. nigra 259
10. Leaves sharply-serrate; calyx-lobes entire....P. americana 261

PULSE OR PEA FAMILY. LEGUMINOSAE

An extremely large family of some four hundred and fifty genera and seven thousand species including trees, shrubs, woody vines, and herbs, widely distributed through the tropical and temperate regions of the world. Many are valuable timber trees while others are important forage crops or are otherwise valuable to man. In addition to the many herbaceous and shrubby forms, there are seventeen genera which are represented by arborescent forms in the United States.

Leaves alternate, usually compound, stipulate. *Flowers* papilionaceous or sometimes regular; stamens 10 (occasionally 5 or many), monadelphous, diadelphous, or rarely distinct; pistil simple, superior, solitary. *Fruit* a legume.

KEY TO THE GENERA

		PAGE
1.	Leaves doubly pinnate at least in part; flowers regular, polygamous or dioecious	2
1.	Leaves simple or pinnate; flowers papilionaceous or imperfectly pseudo-papilionaceous	3
2.	Leaves bipinnate; calyx-tube elongated, 5-lobed; legume thick and woody	Gymnocladus 373
2.	Leaves pinnate and bipinnate; calyx-tube short, 3–5 lobed; legume coriaceous	Gleditsia 373
3.	Leaves simple; upper petal enclosed by the others in the bud	Cercis 374
3.	Leaves pinnate; upper petal enclosing the others in the bud	Robina 374

KENTUCKY COFFEE-TREE. GYMNOCLADUS Lam.

Large trees with stout pithy twigs, large alternate bipinnate leaves, inconspicuous flowers, and large woody legumes. A genus of two species, one native to eastern North America, the other to southern and southwestern China.

Buds superposed. *Leaves* alternate, deciduous, unequally bipinnate, the primary pinnae aside from 1 or 2 basal pairs with many, usually, alternate leaflets; stipules foliaceous, caducous. *Flowers* regular, dioecious or polygamous, greenish white, borne in terminal racemes; calyx elongated-tubular, 10-ribbed, with 5 narrow, nearly equal lobes; petals 5, oblong, equal, pubescent, spreading, somewhat longer than the calyx-lobes; stamens 10, distinct, short, inserted with the petals on the calyx-tube; filaments pubescent, of two lengths; pistil consisting of a sessile ovary terminated by a short style and oblique 2-lobed stigma; ovules numerous. *Fruit* a large, oblong, subfalcate, somewhat compressed, woody legume, tardily dehiscent, containing several seeds separated by a jelly-like pulp; seeds large, ovoid or somewhat obovoid, albuminous, with thick, brown seed-coat.

THE HONEY LOCUSTS. Genus GLEDITSIA L.

A genus of ten or twelve species of trees, natives of eastern North America, Asia, Japan and tropical Africa. Three species are found in the United States, one widely distributed in the east, a second inhabiting the lower Mississippi basin, and a third restricted to a small area in Texas. But one species, *Gleditsia triacanthos* (L.), is found in New York State.

Leaves alternate, deciduous, long-petioled, often fascicled on second year twigs, evenly pinnate, twice pinnate or with some of the secondary pinnae replaced by simple leaflets; leaflets subsessile and irregularly crenulate; stipules small, caducous. *Flowers* regular, polygamous, small, greenish yellow, borne in slender axillary, sometimes fascicled, spike-like racemes with minute caducous bracts; calyx campanulate, with 3–5 nearly equal lobes, petals 3–5, equaling the calyx-lobes; stamens 6–10, distinct, inserted with the petals on the edge of the disk; pistil consisting of a nearly sessile ovary terminated by a short style and terminal dilated stigma; ovules 2 many. *Fruit* a compressed, many-seeded, elongated, straight, indehiscent legume or an ovate, 2-seeded, tardily dehiscent legume; seeds suborbicular or oblong, compressed, albuminous, with long funicles.

THE RED-BUDS. Genus CERCIS L.

A genus of seven species of small trees or shrubs, natives of North America and Eurasia. Three species occur in North America, one widely distributed as a small tree in central and eastern United States, a second in southern Texas, and a third shrubby species in California.

Bark scaly. *Branchlets* slender, zigzag, prolonged by an upper axillary bud. *Leaves* alternate, deciduous, simple, ovate, orbicular or reniform, with 5–7 prominent veins; petioles slender, elongate, enlarged at the base; stipules small, membranous, caducous. *Flowers* appearing before or with the leaves on thin, jointed pedicels in simple fascicles or racemose clusters, borne on the growth of the preceding season, on the older twigs, or even on the trunk, pink, pseudo-papilionaceous; calyx-tube oblique-campanulate, 5-toothed; petals 5, unguiculate, those forming the keel the larger and free; standard smaller than the wings and enclosed by them in the bud; stamens 10, distinct, declined; filaments enlarged and pilose at the base; anthers oblong, pistil consisting of a short-stalked, obliquely-inserted ovary terminated by a filiform style and stout obtuse stigma; ovules numerous, 2-ranked. *Fruit* a linear-oblong, compressed legume, acute at both ends and margined along the upper suture, at maturity reddish purple and 2-valved; seeds oblong, compressed, reddish brown, albuminous.

THE LOCUSTS. Genus ROBINIA L.

A genus of seven or eight species of trees and shrubs characterized by slender zigzag, often armed branchlets; minute superposed subpetiolar buds, alternate pinnate leaves, and showy papilionaceous flowers. The locusts are confined wholly to the temperate parts of North America. Three arborescent and one shrubby species occur within the United States.

Leaves alternate, deciduous, odd-pinnately compound; leaflets entire, petiolulate, with minute bristle-like stipules; stipules persistent, spinescent at least on vigorous growth. *Flowers* large, showy, papilionaceous, perfect, borne on long pedicels in short pendulous racemes from the axils of leaves of the year; calyx-tube campanulate, 5-lobed or cut, the upper lobes the longer and cohering for a part of their length; corolla consisting of a large, reflexed, obcordato standard, oblong-falcate free wings and obtuse, incurved keel-petals united below; stamens 10, diadelphous, the nine inferior united; anthers uniform or the alternate ones smaller; pistil superior, consisting of a stipitate elongated ovary terminating in a subulate inflexed hairy style and terminal stigma; ovules numerous, 2-ranked, attached to the ventral suture. *Fruit* a many-seeded, linear oblong, compressed, nearly sessile legume, flat-margined along the seed-bearing suture and opening by 2 thin membranous valves; the legumes are generally borne in drooping many-fruited racemes and open tardily; seeds oblique, reniform, albuminous with persistent incurved funicle.

RUE FAMILY. RUTACEAE

Trees and shrubs or rarely herbs with bitter aromatic oil, simple or compound, generally glandular-punctate leaves, and perfect or polygamous, usually strongly-scented flowers. The Rue family contains in the neighborhood of one thousand species grouped in one hundred odd genera, widely distributed throughout the warm temperate and tropical regions of the world but most abundant in South Africa and Australia.

Leaves simple or compound, generally glandular-punctate, estipulate or with spinescent stipules. *Flowers* regular, perfect or unisexual, chiefly in cymes; calyx 3–5-lobed, the lobes imbricated in the bud; petals 3–5, imbricated in the bud; stamens as many or twice as many as the petals, distinct or united below, hypogynous; pistils 2–5, separate or united, sessile or stipitate, the styles usually united; ovules 2 in each cell. *Fruit* a capsule, samara, drupe or hesperidium; seeds albuminous.

THE WAFER-ASHES. Genus PTELEA L.

Small trees or shrubs with bitter bark, 3–5-foliate leaves, polygamous flowers, and samaroid fruit. The genus is endemic to North America and is represented by four or five species, natives of the United States and Mexico. One species becomes a small tree and is found locally in New York State.

Leaves alternate or rarely opposite, estipulate, long-petioled, generally trifoliate, the leaflets ovate or oblong, entire or crenulate-serrate, pellucid-punctate. *Flowers* polygamous, greenish white, borne on slender bracteolate pedicels in terminal or compound cymes; calyx 4–5-parted; petals 4–5, imbricated; stamens of the same number as the petals and alternate with them; filaments subulate, pilose at the base, shorter in the pistillate flowers; pistil consisting of a stipitate, compressed 2-3-celled ovary terminated by a short style and 2–3-lobed stigma. *Fruit* a 2–3-celled, broadly winged or rarely wingless samara; wing broad, reticulate; seeds oblong, acute at the apex, rounded at the base.

QUASSIA FAMILY. SIMAROUBACEAE

Trees or shrubs with bitter often milky juice, alternate pinnate leaves, dioecious or polygamous flowers, and a samaroid or drupaceous fruit. The family includes about one hundred and fifty species which are grouped in twenty-eight genera, and is chiefly confined to the tropics and the milder parts of the north temperate zone.

Leaves alternate, persistent or deciduous, pinnate, estipulate. *Flowers* regular, dioecious or polygamous; calyx 3–5 lobed, the lobes imbricated in the buds; petals 3–5, imbricated in the bud; disk annular or elongated; sta-

mens as many as the petals or twice as many, distinct; filaments with a scale or hairs at the base, inserted under the disk; anthers 2-celled, introrse; pistil consisting of a 2–5-celled ovary terminated by a like number of styles. *Fruit* a drupe or samara.

TREE OF HEAVEN. Genus AILANTHUS Desf.

Trees or shrubs with pale bitter bark, pinnate leaves, greenish white flowers and samaroid fruit. The genus contains seven or eight species, all natives of eastern Asia, the East Indies and Australia. *Ailanthus glandulosa* Desf. has become widely naturalized about cities and towns in eastern United States.

Leaves alternate, petioled, deciduous, odd-pinnately compound, consisting of numerous, somewhat oblique, ovate or ovate-lanceolate sub-entire leaflets. *Flowers* small, polygamous, greenish white, borne in large terminal panicles; calyx short, 5-cleft; petals 5, spreading, valvate; disk hemispheric, 10-lobed; staminate flowers ill-scented, with ten stamens; fertile flowers with 2–3 abortive or functional stamens; pistil consisting of a deeply 2–5-lobed ovary surmounted by a like number of united styles. *Fruit* a linear-oblong samara with membranous veiny wing surrounding the 1-seeded seminal cavity; samaras generally clustered.

SUMACH FAMILY. ANACARDIACEAE

Trees, shrubs or vines with acrid resinous or milky juice, pithy branchlets, alternate simple or compound leaves, generally polygamous flowers, and drupaceous fruit. A large family comprising about fifty genera and some four hundred species, natives of tropical or the milder portions of the temperate zones.

Leaves alternate, simple or pinnate, estipulate. *Flowers* regular, minute, dioecious or polygamous; calyx-lobes generally 5; petals of the same number or wanting; stamens of the same number as the petals or twice as many and inserted with them on the edge of an annular disk; filaments filiform; anthers oblong, 2-celled, longitudinally dehiscent; pistil consisting of a 1-celled, 1-ovuled ovary terminated by 1–3 styles and stigmas. *Fruit* a small drupe; seed exalbuminous; cotyledons fleshy.

THE SUMACHS. Genus RHUS L.

The genus *Rhus* includes more than a hundred species of trees, shrubs, and climbing vines, chiefly natives of the milder portions of the north and south temperate zones. Some are extremely poisonous; others are important as sources of tannin material, waxes and gums, and as ornamental plants. Sixteen or seventeen species are indigenous to the United States and are scattered from coast to coast. Five of these become small trees.

Branchlets stout, pithy, exuding a milky or watery juice when bruised. *Leaves* alternate, deciduous or persistent, chiefly odd-pinnately compound. *Flowers* dioecious or polygamous, white or greenish white, borne in more or less compound axillary or terminal panicles; calyx generally 5-cleft or parted, persistent; petals 5, spreading, longer than the calyx-lobes; stamens 5, alternate with the petals, inserted with them under the margin of an annular disk; pistil consisting of a sessile ovary terminated by 3 terminal styles and stigmas. *Fruit* a globose, smooth or hairy drupelet, borne chiefly in thyrses; flesh thin, often acidulous; pit bony or crustaceous.

KEY TO THE SPECIES

		PAGE
1.	Flowers in terminal thyrsoid panicles; drupelet clothed with acid crimson hairs 2	
1.	Flowers in loose, slender, axillary panicles; drupelet glabrous, white ..... R. Vernix	285
2.	Rachis of the leaf not winged; juice milky 3	
2.	Rachis of the leaf winged; juice watery ..... R. copallina	283
3.	Leaf-stalks and branchlets densely velvety-hairy ..... R. typhina	279
3.	Leaf-stalks and branchlets glaucous ..... R. glabra	281

HOLLY FAMILY. AQUIFOLIACEAE

Trees and shrubs with terete branchlets, scaly buds, alternate simple leaves, inconspicuous flowers, and a drupaceous fruit. A family of about one hundred and seventy-five species widely distributed in the temperate and tropical regions of the world. One genus is represented by arborescent forms in the United States.

Leaves alternate, deciduous or persistent, simple, entire, crenate or pungently toothed, stipulate. *Flowers* greenish white, dioecious, axillary, solitary or cymose; calyx 4–6-lobed; petals 4–6, imbricated in the bud; stamens 4–6, alternate with the petals, inserted on the petals at the base, reduced to staminodia in the pistillate flower; ovary 4–8 celled; style short or none; stigmas 4–8. *Fruit* a drupe with thin flesh, containing 4–8 horny or crustaceous nutlets; seeds pendulous, albuminous.

THE HOLLIES. Genus ILEX L.

A genus of about one hundred and sixty species of trees and shrubs widely scattered throughout the temperate and tropical regions of the world with the exception of western North America, Australia and neighboring islands. Thirteen species are found in eastern United States, five of which become arborescent. Two of the latter are found in New York State, one of which, *Ilex opaca* Ait., becomes a small tree within our range.

For generic characters, see those of the family.

MAPLE FAMILY. ACERACEAE

Trees and a few shrubs with watery often saccharine juice, terete branches, opposite simple palmately lobed or pinnate leaves, and polygamous or dioecious flowers. The *Aceraceae* consist of

but two genera, *Dipteronia,* represented by a single species in China and *Acer,* with numerous species widely distributed over the northern hemisphere.

Leaves opposite, deciduous, simple and palmately lobed or pinnate, long-petioled, chiefly estipulate. *Flowers* regular, polygamous, dioecious, or rarely perfect, borne in lateral fascicles arising from separate flower-buds before the leaves or in terminal and lateral racemes or panicles with or after the leaves; calyx chiefly 5-parted, the segments imbricated; petals 5 or none; disk thick, annular, lobed, or sometimes lacking; stamens 4–12 (usually 7–8), hypogynous, with filiform filaments and oblong or linear anthers; pistil consisting of a 2-lobed, 2-celled, compressed, wing-margined ovary surmounted by 2 styles which are stigmatic on their inner surface; ovules 2 in each cell. *Fruit* a double samara, the halves usually long-winged and 1-seeded, and joined at the base; wings papery, thickened on the margin; seed compressed, ascending, exalbuminous; cotyledons thin, folded.

THE MAPLES. Genus ACER L.

The genus *Acer* consists of seventy to eighty species of trees and shrubs scattered over the northern hemisphere of the New and the Old World, one species crossing the equator into Sumatra and Java. Some thirteen forms are found in North America, six species (including one variety) occurring within the area of New York State. Some species are important timber trees producing a close-grained, moderately hard wood which is prized for furniture, in turnery and for interior finish. Maple sugar is obtained from the sap of *Acer saccharum* Marsh. The maples are also used extensively as shade trees.

For generic characters, see those of the family.

KEY TO THE SPECIES

		PAGE
1.	Leaves simple, palmately veined and lobed	2
1.	Leaves pinnately compound	A. Negundo 301
2.	Flowers in terminal racemes	3
2.	Flowers in lateral clusters	4
3.	Racemes erect; leaves coarsely serrate, usually 3-lobed at the apex	A. spicatum 291
3.	Racemes drooping; leaves finely doubly serrate, 3-lobed at the apex	A. pennsylvanicum 289
4.	Flowers appearing with the leaves in nearly sessile, umbel-like, pendant corymbs	5
4.	Flowers appearing before the leaves in umbel-like fascicles from separate buds	6
5.	Leaves dark green above, glabrous beneath at maturity	A. saccharum 293
5.	Leaves yellowish green above, usually downy beneath	A. saccharum, var. nigrum 295
6.	Petals wanting; sides of terminal lobe of leaf diverging	A. saccharinum 297
6.	Petals present; sides of terminal lobe of leaf converging	A rubrum 299

SOAPBERRY FAMILY. SAPINDACEAE

Trees, shrubs, lianas, or herbaceous vines with watery juice, chiefly alternate compound estipulate leaves, and mainly polygamous unsymmetrical flowers. A large family comprising more than one hundred genera and one thousand species widely distributed in the tropical and warm temperate regions of the world. But one genus, *Aesculus*, is represented by a naturalized arborescent form in New York State.

Leaves alternate (opposite in one genus), pinnate or palmate, persistent or deciduous, estipulate. *Flowers* regular or irregular, polygamous; sepals or calyx-lobes 4–5, imbricated in the bud; petals 3–5, imbricated in the bud; disk annular, fleshy; stamens generally 7–10, inserted on the disk, with free filaments and introrse 2-celled anthers; pistil consisting of a 2–4-celled ovary surmounted by a terminal style and capitate or lobed stigma; ovules solitary or 2 in a cell. *Fruit* a drupe or capsule; seed usually solitary by abortion, exalbuminous.

THE HORSE-CHESTNUT AND BUCKEYES. Genus AESCULUS L.

Trees and shrubs with stout branchlets, large buds, ill-scented bark, and showy paniculate flowers. *Aesculus* includes ten or twelve species which are found in North America and Eurasia.

Leaves opposite, deciduous, digitately compound, petiolate, estipulate; leaflets 3–9, serrate. *Flowers* polygamous, showy, borne in large terminal panicles, generally only the lower flowers fertile; pedicel jointed; calyx campanulate, 5-lobed. the lobes unequal and imbricated in the bud; petals 4–5, unequal, clawed; disk hypogynous, annular; stamens chiefly 7, with elongated filiform unequal filaments and introrse, longitudinally dehiscent anthers; pistil consisting of a 3-celled sessile ovary surmounted by a slender, elongated curved style and capitate stigma; ovules 2 in each cell. *Fruit* a coriaceous, 3-valved, 1–2 seeded capsule, loculicidally dehiscent; seeds large, globose or hemispherical, smooth, lustrous, brown, with large pale hilum, exalbuminous; cotyledons thick fleshy, hypogean.

Aesculus is represented in New York State by but the one naturalized species *Æ. Hippocastanum* L., a native of the Orient.

BUCKTHORN FAMILY. RHAMNACEAE

Small trees and erect or climbing shrubs with bitter bark, simple and mainly alternate leaves, and perfect, polygamous, or dioecious inconspicuous flowers. The *Rhamnaceae* include about forty-five genera and some six hundred species, chiefly natives of the tropical and warmer parts of the temperate regions. But one genus, *Rhamnus*, is represented by an arborescent species in New York State.

Leaves simple, chiefly alternate and generally 3-nerved, stipulate. *Flowers* perfect or polygamous, regular, greenish, inconspicuous; calyx 4–5-lobed; petals 4–5, inserted on the calyx or wanting; stamens 4–5, opposite the petals; disk fleshy; pistil consisting of a sessile 2–5-celled and ovuled ovary surmounted by a columnar style and terminal stigma. *Fruit* drupaceous, tipped with the remnants of the style; seeds mainly albuminous.

THE BUCKTHORNS. Genus RHAMNUS (Tourn.) L.

Small trees and shrubs with bitter bark, often spinescent branches, simple pinniveined leaves, and greenish, perfect, polygamous or dioecious flowers. *Rhamnus* is represented by about sixty species scattered over the temperate and in many parts of the tropical regions of the world. Five species are indigenous to the United States, three of which become arborescent.

Leaves alternate or subopposite, deciduous or persistent, simple, entire or dentate, petiolate, conduplicate in the bud. *Flowers* perfect or polygamo-dioecious, axillary, borne in simple or compound racemes or fascicled cymes; calyx, campanulate, 4–5-lobed; petals 4–5, emarginate, infolded around the stamens or lacking; stamens 4–5, with short filaments and ovate-oblong or sagittate anthers; pistil consisting of a free 2–4-celled, ovoid ovary surmounted by a 3–4-cleft or lobed style. *Fruit* an oblong or spherical drupe with thick succulent flesh, containing 2–4 1-seeded nutlets; seed erect, grooved, with scanty albumen.

Rhamnus cathartica L. was introduced from Europe for ornamental purposes and has become naturalized in New York State.

LINDEN FAMILY. TILIACEAE

A large family of trees, shrubs and herbs comprising about thirty-five genera and approximately two hundred and fifty species, mainly tropical and most abundantly represented south of the equator. Three genera are North American, one of which, *Tilia*, is arborescent.

Leaves chiefly alternate, simple, deciduous, stipulate. *Flowers* perfect, regular, generally in cymes or panicles; sepals 3–5, valvate, deciduous; petals of the same number, fewer, or none; stamens numerous, generally 5–10-adelphous; pistil consisting of a sessile, 2–10-celled ovary terminated by a columnar style and capitate stigma. *Fruit* drupaceous or nut-like; seeds albuminous; cotyledons foliaceous.

THE LINDENS OR BASSWOODS. Genus TILIA (Tourn.) L.

The genus *Tilia* comprises some twenty species of trees and is widely distributed in the temperate regions of the northern hemisphere with the exception of western North America and Central Asia. Most of the species are characterized by fragrant, nectar-bearing flowers, fibrous inner bark, and a soft, even-textured valuable wood, and are valuable timber trees in the regions to which they are indigenous.

Leaves alternate, deciduous, simple, mainly cordate and inequilateral at the base, serrate, long-petiolate. *Flowers* perfect, pale yellow, fragrant, nectariferous, borne on slender clavate pedicels in axillary or terminal cymes, the stalk of the cyme in part adnate to the axis of a ligulate or obovate, pale green, membranous bract; sepals 5; petals 5, alternate with the sepals, creamy white; stamens numerous, 5-adelphous, each cluster (in the American species) united with a petal-like scale opposite each petal; filaments forked at the apex, each fork bearing a half-anther; pistil consisting of a sessile, tomentose, 5-celled ovary surmounted by a columnar style and 5 spreading stigmatic lobes. *Fruit* nut-like, woody, subglobose to ovate-oblong, 1-celled by abortion and containing 1–2 albuminous seeds; cotyledons palmately 5-lobed.

KEY TO THE SPECIES

PAGE

1. Leaves glabrous below.....T. americana 307
1. Leaves pubescent or hoary-tomentulose below.....2
2. Leaves stellate pubescent below, with conspicuous axillary tufts of hairs. T. Michauxii 309
2. Leaves hoary white-tomentulose below....T. heterophylla, var. Michauxii 311

GINSENG FAMILY. ARALIACEAE

Trees, shrubs, or herbs, with watery juice, alternate compound leaves, racemose or panicled umbels of flowers, and baccate fruit. A large family of about fifty genera and five hundred species, mainly confined to the tropics with a few genera extending into the northern hemisphere. *Aralia* is represented by four species in New York State, one of which becomes a small tree.

Leaves alternate, deciduous, compound, petiolate, mainly stipulate. *Flowers* perfect or polygamous, regular, 5-merous, in racemose or panicled umbels; calyx adnate to the ovary, 5-lobed; petals 5 or 10, inserted on the margin of the calyx; stamens 5 or 10, alternate with the petals; pistil consisting of an inferior 2–5-celled ovary surmounted by 2–5 styles and simple stigmas; ovules one to each cell. *Fruit* a 2–5-seeded, baccate drupe; seeds exalbuminous.

HERCULES' CLUB. Genus ARALIA (Tourn.) L.

Aromatic spiny trees or shrubs with stout pithy branches, and bristly or glabrous perennial herbs. The genus comprises about thirty species and is confined to North America and Asia. *Aralia spinosa* L. is the only North American species which becomes arborescent.

Leaves alternate, pinnately or ternately decompound, the petioles enlarged and clasping at the base; stipules present. *Flowers* perfect or polygamous, small, greenish white, 5-merous, borne on slender, jointed pedicels in umbels or panicled umbels; calyx-tube adherent to the ovary, the lobes minute and valvate; petals ovate, imbricated in the bud; stamens alternate with the petals, with filiform filaments and oblong or ovate anthers, inserted with the petals on the margin of the disk; pistil consisting of an inferior 2–5-celled

ovary surmounted by a like number of styles and capitate stigmas. *Fruit* a 2–5-seeded, laterally compressed or angled, baccate drupe, tipped with the remains of the styles and calyx-lobes; nutlets orbicular to ovate-oblong, compressed, 1-seeded; seeds albuminous.

DOGWOOD FAMILY. CORNACEAE

Trees, shrubs, or herb-like shrubs, with watery juice, terete branchlets, alternate or opposite deciduous leaves, and perfect or polygamo-dioecious flowers. The family includes about sixteen genera and some ninety species, chiefly natives of the north temperate zones. Two genera have arborescent species in North America.

Leaves alternate or opposite, deciduous, simple, estipulate. *Flowers* regular, borne solitary, in heads or cymes; calyx-tube adherent to the ovary, its limb 4–5-toothed or wanting; petals 4–5 or sometimes wanting; stamens 4–5 or more numerous with subulate or flat filaments, inserted with the petals on the margin of the epigynous disk; pistil consisting of an inferior, 1–2 celled, 1–2 ovuled ovary surmounted by a simple style and stigma. *Fruit* a 1–2 seeded, 1-pitted drupe; seeds oblong, albuminous.

KEY TO THE GENERA

		PAGE
1. Leaves mostly opposite; flowers perfect, 4-merous	Cornus	382
1. Leaves alternate; flowers polygamo-dioecious, 5-merous	Nyssa	383

THE DOGWOODS OR CORNELS. Genus CORNUS (Tourn.) L.

Trees, shrubs, or shrub-like herbs, with astringent bark, opposite or rarely alternate leaves, small perfect flowers and drupaceous fruit. The genus comprises some forty species, confined to the temperate regions of the northern hemisphere aside from a single species in Peru. Some seventeen species occur in North America, four of which become arborescent.

Leaves opposite or rarely alternate, simple, deciduous. *Flowers* perfect, small, white, greenish white or yellow, 4-merous, borne in cymes or heads, the latter subtended by showy white bracts in some species; calyx adherent to the ovary, the limb minutely 4-toothed; petals 4, valvate in the bud; stamens 4, alternate with the petals and inserted with them on the margin of the disk, the filaments slender and exserted; pistil consisting of an inferior 2-celled, 2-ovuled ovary surmounted by a columnar style and capitate or truncate stigma. *Fruit* an oblong or ovoid drupe, with thin flesh and bony or crustaceous 2-seeded stone.

KEY TO THE SPECIES

		PAGE
1. Leaves opposite; flowers greenish, capitate, the heads surrounded by 4 large, white, involucral bracts; fruit red	Cornus florida	315
1. Leaves alternate; flowers creamy white, in naked cymes; fruit dark blue	Cornus alternifolia	317

THE TUPELOS. Genus NYSSA L.

Trees with alternate simple leaves, inconspicuous polygamo-dioecious flowers, and drupaceous fruit. *Nyssa* is represented by five species in the eastern United States and a single species in Southern Asia. One species, *Nyssa sylvatica* Marsh., occurs in New York State.

Leaves alternate, deciduous, simple, entire or angulate-toothed, petiolate, generally grouped near the end of the branches. *Flowers* appearing before the leaves, polygamo-dioecious, small, greenish white, inconspicuous, borne in capitate clusters, short racemes, or solitary at the summit of slender axillary peduncles; staminate flowers numerous; calyx 5-parted; petals 5, minute, fleshy, or none; stamens 5–15, with slender filaments and oblong anthers; fertile flowers solitary or in few-flowered clusters, subtended by bracts; calyx-limb 5-toothed or truncate; petals 5, minute or none; stamens 5–10, with short filaments and fertile or abortive anthers; pistil consisting of an inferior, 1-celled, 1-ovuled ovary surmounted by a slender curved style stigmatic on one side toward the apex. *Fruit* an oblong or ovoid drupe, with thin acidulous flesh and thick-walled, bony, terete or compressed, ridged or winged, generally 1-celled, 1-seeded pit; seed pale, filling the cavity of the pit.

Series 3. GAMOPETALAE

Plants with petals more or less united, or sometimes separate or wanting.

HEATH FAMILY. ERICACEAE

Trees and shrubs with scaly buds, alternate simple leaves, perfect regular flowers, and capsular, drupaceous or baccate fruit. A large family consisting of about sixty-seven genera and over one thousand species, widely scattered throughout the world in tropical and temperate regions. Twenty-one genera are represented in the United States, seven of which include arborescent forms.

Leaves alternate, simple, estipulate. *Flowers* perfect, regular, 4- or 5-merous; calyx 4–5-lobed, free or adnate to the ovary; corolla regular, 4–5-lobed, the lobes imbricated in the bud; stamens as many or twice as many as the lobes of the corolla, with short filaments and anthers opening by a terminal pore and often appendaged; pistil consisting of a 4–10-celled superior or inferior ovary terminated by a columnar style and capitate stigma. *Fruit* capsular, drupaceous, or baccate; seeds generally minute, albuminous.

KEY TO THE GENERA

PAGE

1. Leaves flat; flower clusters axillary; corolla 5-lobed..... Kalmia 384
1. Leaves revolute; flower clusters terminal; corolla 5-cleft..... Rhododendron 384

THE LAURELS. Genus KALMIA L.

Small trees and shrubs with terete branchlets, minute axillary leaf-buds, elongated axillary inflorescence-buds, and fibrous root. Five or six species are recognized, natives of the United States and Cuba. One species, *Kalmia latifolia* L., becomes arborescent in eastern United States.

Leaves alternate, persistent, entire, short petiolate. *Flowers* perfect, showy, pink, purple or white, borne on slender bibracteolate pedicels from the axils of persistent bracts in axillary umbels; calyx 5-parted, persistent, the lobes imbricated in the bud; corolla saucer-shaped, 5-lobed, with short tube and 10 pouches just below the limb, the lobes ovate and before anthesis prominently 10-ribbed from the pouches to the acute apex of the bud; stamens 10, shorter than the corolla, with oblong anthers and filiform filaments; prior to anthesis the anthers are retained in the pouches but at maturity the stamen straightens abruptly and catapults the pollen grains from terminal pores in the anthers; disk 10-lobed; pistil consisting of a subglobose, 5-celled, many-seeded ovary terminated by a filiform exserted styles and capitate stigma. *Fruit* a subglobose crustaceous, 5-celled capsule which is tardily septicidally dehiscent; seeds minute, albuminous.

THE RHODODENDRONS. Genus RHODODENDRON L.

Small trees and shrubs with astringent juice, scaly bark, terete branchlets, alternate leaves, and showy flowers. The genus includes over two hundred species which are scattered over eastern and southern Asia and adjoining islands, and North America. Eighteen species occur in North America, one of which, *Rhododendron maximum* L., becomes arborescent. In addition horticulturists have introduced and hydridized many exotic forms for ornamental purposes.

Leaves alternate, clustered near the ends of the branchlets, persistent; coriaceous, with revolute entire margins and broad midribs, short-petiolate. *Flowers* perfect, showy, arising from scaly, cone-like buds, borne in terminal corymbs or panicles; calyx 5-parted or toothed, persistent; corolla campanulate, 5-cleft, deciduous; disk fleshy, lobed; stamens generally 10, somewhat unequal, declined and spreading; filaments pilose at the base; pistil consisting of a 5-celled ovary surmounted by a slender, exserted, persistent style and capitate stigma. *Fruit* a 5-celled, 5-valved, many-seeded, septicidally dehiscent capsule; seeds numerous, minute, laciniately winged at the ends, albuminous.

EBONY FAMILY. EBENACEAE

Trees and shrubs with watery juice, alternate simple entire leaves, dioecious or polygamous flowers, and baccate fruit. The *Ebenaceae* include five genera and about two hundred and seventy-five species, widely distributed in tropical and the milder parts of the temperate regions.

Leaves simple, alternate, entire, estipulate. *Flowers* small, chiefly dioecious or polygamous, regular, axillary, solitary or cymose; calyx inferior, persistent, 3–7-lobed; corolla regular, deciduous, 3–7-lobed; stamens more numerous than the lobes of the corolla and inserted on its tube, with short filaments and introrse anthers; pistil consisting of a several-celled ovary surmounted by 2–8 styles and stigmas; ovules 2 in each cell. *Fruit* a 1–several-seeded berry subtended by the accrescent calyx; seeds albuminous.

THE PERSIMMONS. Genus DIOSPYROS L.

Diospyros includes about one hundred and sixty species, widely distributed throughout the tropics of the world but most abundant in southern Asia. A few species extend into the temperate regions of eastern Asia, eastern North America, and the Mediterranean area. The ebony of commerce is produced by certain members of this genus while others produce edible fruit. *Diospyros* is represented by two species in the United States, one of which, *Diospyros virginiana* L., occurs in southern New York.

Leaves alternate, simple, coriaceous, entire, estipulate. *Flowers* dioecious, polygamous, or occasionally perfect, regular, from the axils of the leaves of the year or of the previous year; staminate flowers smaller than the pistillate; usually in short few-flowered cymes; pistillate flowers chiefly solitary; calyx 3–7-lobed, persistent and usually accrescent; corolla regular, 3–7-lobed, the lobes convolute in the bud; stamens 2–3 times the number of corolla-lobes, inserted at the base of the corolla in two rows and in pairs, with slender filaments and oblong apiculate anthers, abortive in the pistillate flowers; pistil consisting of an inferor 3–7-celled ovary surmounted by 3–7 spreading styles, each bearing 2-lobed or parted stigmas at the apex. *Fruit* a globose, oblong or conical 1–10-seeded berry, subtended at the base by the accrescent persistent calyx; seeds oblong, compressed, albuminous.

OLIVE FAMILY. OLEACEAE

Trees or shrubs with watery juice, scaly buds, opposite estipulate leaves, perfect, dioecious or polygamous flowers, and capsular, baccate, drupaceous, or samaroid fruit. The family includes about twenty genera and five hundred species, widely distributed in temperate and tropical regions but chiefly in the northern hemisphere. Five genera are indigenous to the United States, one of which has arborescent representatives in New York State.

Leaves opposite, simple or compound, estipulate. *Flowers* perfect, dioecious, or polygamous, regular, paniculate, cymose, or fasciculate; calyx inferior, 2–4 lobed, or none; corolla of 2–4 petals or none, stamens 2–4, with short filaments and introrse, often apiculate anthers; pistil consisting of a 2-celled ovary surmounted by a single style and terminal stigma. *Fruit* a samara or berry in the American species; seeds albuminous.

THE ASHES. Genus FRAXINUS (Tourn.) L.

Trees and shrubs with stout pithy branches, opposite odd-pinnate or occasionally simple leaves, dioecious, polygamous or rarely perfect flowers, and samaroid fruit. The genus *Fraxinus* includes about forty species, widely distributed in the northern hemisphere and in Cuba and Java. Sixteen species occur in the United States, fifteen of which are arborescent and include some of our most valuable timber trees. Three species and a variety are indigenous to New York State.

Leaves opposite, deciduous, odd-pinnately compound or rarely reduced to a single leaflet, petiolate; leaflets generally serrate; petiolulate or sessile. *Flowers* dioecious, polygamous, or rarely perfect, vernal, borne on slender pedicels in open or compact axillary panicles, terminal or axillary on shoots of the year or axillary on the growth of the preceding season; calyx small, campanulate or none; corolla 2–4 parted or none; stamens chiefly 2, with short filaments and large oblong anthers; pistil consisting of a mostly 2-celled ovary crowned by a simple style and 2-lobed stigma. *Fruit* a samara with terete or somewhat compressed, chiefly 1-seeded body and terminal wing; seed elongated, exalbuminous.

KEY TO THE SPECIES

1. Leaflets petiolulate; body of the fruit essentially terete; wing not extending to the base 2
1. Leaflets sessile; body of the fruit compressed; wing extending to the base .... F. nigra 333
2. Leaflets obscurely serrate, pale beneath 3
2. Leaflets sharply serrate, bright green beneath ..... F. pennsylvanica, var. lanceolata 331
3. Petioles and branchlets glabrous or nearly so ..... F. americana 327
3. Petioles and branchlets velvety-pubescent ..... F. pennsylvanica 329

THE FIGWORT FAMILY. SCROPHULARIACEAE

Herbs, shrubs, vines and a few trees, with simple opposite, whorled or alternate leaves, mainly perfect, irregular and usually showy flowers, and capsular fruit. The family includes about one hundred and eighty genera and twenty-five hundred species, widely distributed through tropical and temperate regions. In addition to many herbs, *Paulownia* is represented by a single naturalized arborescent species in New York State.

Leaves simple, variously arranged, estipulate. *Flowers* generally perfect, complete, irregular and often zygomorphic, generally showy; calyx 4–5-toothed, cleft or divided, persistent; corolla more or less irregular, mainly 2-lipped; stamens 2, 4 or 5, generally didynamous, inserted on the corolla-tube, with long, slender filaments and 1–2-celled anthers; pistil consisting of a 2-celled, many-ovuled ovary surmounted by a slender, usually simple style and simple or 2-lobed stigma. *Fruit* capsular, 2-valved; seeds numerous, albuminous.

THE PAULOWNIA TREE. PAULOWNIA Sieb. and Zucc.

Trees with watery juice, stout pithy branches, opposite simple leaves, showy paniculate flowers, and capsular fruit. The genus contains two species which are native to Japan and China. *Paulownia tomentosa* (Thunb.) Steud. has become naturalized as an escape in southern New York State.

Leaves large, simple, opposite, deciduous, cordate, pubescent, long-petioled, estipulate. *Flowers* large, showy, violet in color, borne on stout, velvety pedicels in large, terminal panicles; calyx persistent, 5-cleft, the lobes short and obtuse; corolla-tube hairy without, 5-lobed, the lobes unequal and spreading; stamens 4, didynamous, with slender filaments and wide-spreading anther-sacs; pistil consisting of a 2-celled, many-ovuled ovary surmounted by a long style which is thickened and stigmatic toward the apex. *Fruit* a broadly ovoid, woody, abruptly pointed, 2-celled capsule, 1–2 inches long, opening loculicidally at maturity but persisting on the trees into the winter; seeds small, numerous, lace-winged.

TRUMPET-CREEPER FAMILY. BIGNONIACEAE

Trees, shrubs, lianas and a few herbs with watery juice, opposite, whorled or rarely alternate leaves; generally showy flowers, and capsular or baccate fruit. The family includes about one hundred genera and in the neighborhood of five hundred species. Five genera are represented in the United States, three of which are arborescent.

Leaves simple or compound, opposite, whorled or rarely alternate, estipulate. *Flowers* large, showy, perfect, more or less irregular; calyx bilabiate; corolla somewhat bilabiate, 5-lobed, the lobes imbricated in the bud; stamens 2 or 4, inserted at the base of the corolla, introrse; staminodia 1–3; pistil consisting of a 1–2-celled, many-ovuled ovary surmounted by a slender 2-lobed style, stigmatic at the apex. *Fruit* a linear, woody, loculicidally-dehiscent, 2-valved capsule, or baccate; seeds exalbuminous.

THE CATALPAS. Genus CATALPA Scop.

Rapidly growing trees with stout, terete, pithy branchlets, opposite or whorled leaves, showy paniculate flowers, capsular fruit, and soft durable wood. The genus *Catalpa* includes seven species, natives of the eastern United States, the West Indies, and eastern China. Two species have become naturalized in New York State.

Leaves large, simple, entire or sparingly lobed, long-petiolate, opposite or in whorls of three, deciduous. *Flowers* large, showy, borne on slender, bracteolate pedicels in terminal, trichotomously-branched, compound panicles or corymbs; calyx bilabiate in opening; corolla broadly campanulate, oblique, membranaceous, variously spotted within, with spreading, 2-lipped, 5-lobed

limb; corolla lobes undulate; stamens 2, ascending under the anterior lip of the corolla, with flattened arcuate filaments and divergent anther-cells; staminodia 3, free, filiform, or rudimentary; pistil consisting of a sessile, 2-celled ovary, contracted above into an elongated, filiform style bearing 2 stigmatic lobes at the apex. *Fruit* an elongated, subterete, pod-like capsule, loculicidally dehiscent, persisting on the trees during the winter; seeds numerous, compressed, oblong, with broad, lateral, fimbriated wings, inserted in 2–4 ranks near the margin of the flat, more or less thickened, woody septum.

KEY TO THE SPECIES

PAGE

1. Leaves caudate-acuminate; flowers in few-flowered open panicles; fruit stout, thick-walled ..... C. speciosa 339
1. Leaves short-acuminate; flowers in many-flowered crowded panicles; fruit slender, thin-walled ..... C. bignonioides 337

HONEYSUCKLE FAMILY. CAPRIFOLIACEAE

Trees, shrubs, lianas, or perennial herbs with watery juice, scaly buds, opposite leaves, cymose flowers, and drupaceous, capsular or baccate fruit. The family includes ten genera and about three hundred species, widely distributed in the northern hemisphere but with a few species extending into the tropics and southward. Two genera are represented by arborescent species in the United States.

Leaves opposite, petiolate, mainly estipulate. *Flowers* regular, perfect, borne in terminal or axillary compound cymes; calyx-tube adnate to the ovary, 5-toothed; corolla epigynous, 5-lobed and sometimes 2-lipped; stamens 5, inserted on the tube of the corolla and alternate with its lobes, with slender filaments and oblong anthers; pistil consisting of an inferior or partly inferior 1–5-celled, 1–5-ovuled ovary terminated by a short style and 3–5-lobed capitate stigma. *Fruit* a 1–5-celled drupe, capsule or berry; seeds albuminous.

THE NANNY-BERRIES, ETC. Genus VIBURNUM (Tourn.) L.

Shrubs and small trees with tough flexible branchlets, opposite deciduous leaves, cymose flowers, and drupaceous fruit. The genus includes approximately one hundred species, widely distributed in the north temperate regions of the New and the Old World, a few extending into the tropics and southward. Fifteen species occur in North America, three of which become arborescent in the Atlantic States.

Buds enveloped in a single pair of scales, or naked, generally large. *Leaves* opposite, simple, deciduous, chiefly estipulate; petioles often broad at the base. *Flowers* white or rarely pink, showy, borne on short, bracteolate pedicels in flat, compound cymes, the outer flowers sometimes radiant and neutral; calyx-tube cylindrical, with short, equally 5-lobed limb, persistent in fruit; corolla rotate, equally 5-lobed, spreading and reflexed after anthesis; stamens

5, inserted on the base of the corolla and alternate with the lobes, exserted, with elongated filaments and bright yellow anthers; pistil consisting of a 1-celled, inferior ovary surmounted by a conical style bearing 3 stigmatic lobes at the apex. *Fruit* a 1-celled, 1-seeded drupe with soft pulp and thin-crustaceous tumid or compressed stone. Two arborescent species of *Viburnum* occur in New York State.

KEY TO THE SPECIES

PAGE

1. Leaves ovate, at least the upper caudate-acuminate.....V. Lentago 341
1. Leaves mainly oval, rounded or acute at the apex.....V. prunifolium 343

TREE ZONES AND TREE DISTRIBUTION IN NEW YORK STATE

A bulletin covering the trees of New York State would not be complete were the subject in hand to be dismissed without at least a cursory treatment of the tree zones and tree distribution within the state. The following paragraphs are written with this idea in mind in the hope that the reader may gain some insight into the factors which govern tree distribution and which have led to regional dissemination of tree species within our borders. In this connection it would seem wise to discuss briefly the fundamentals which underlie forest distribution and to point out that the tree and tree aggregate, that is, the forest, are the logical outcome of such factors, working in unison.

DEVELOPMENT OF DENDROID PLANTS

If our theories of evolution are tenable, the most primitive plants were unicellular and therefore undoubtedly microscopic. We need not concern ourselves here with the argument as to whether they were aquatic or terrestrial, but all are agreed that they were extremely simple, and, being unicellular, exhibited no division of labor. In time multicellular plants were evolved in which division of labor developed. Cell division, and consequently growth, were restricted to certain cells, while others, in some cases, at least, became greatly modified and served as anchors or organs of attachment. With the development of vascular (conducting) tissue division of labor progressed a step further, and the organism increased in size owing to its ability to move food absorbed or elaborated in one part to distant parts where needed. Finally seed plants, as opposed to spore plants, arose in response to a necessity brought about by a semi-hostile environment, permitting of the tiding over of the organisms during unfavorable (cold and dry) seasons and insuring wider dissemination.

But nature was yet to outdo her previous attempts at evolution in the development of the dendroid plant, that is, the tree. These magnificent organisms towered aloft over their humbler brethren and were thus in a position, owing to their greater stature, to have first call on that which is essential for the growth of all green plants, namely, light. Whether trees arose as a result of direct competition between plants for light, etc., or purely as the out-

come of optimum growth conditions which led to better nourished individuals of greater stature is open to argument. In any case I would have you think of the tree as the king of plants, towering far above its smaller kinsmen and haughtily permitting them the crumbs of existence after its own wants are satisfied. But the race is not always to the swift nor to the mighty. History tells us that massive stature may oft predict extinction. Who knows but that the mighty lords of the forest may, as evolution goes on, succumb in the battle for existence? The trend of evolution for the future is problematical.

THE CLIMAX FOREST

But the kingdom of the tree is limited. He rules supreme in woodlands by the grace of a better interpretation of and adaptation to environmental factors such as precipitation (rain, atmospheric moisture, etc.), and temperature which permit of his dominance, nay, his very existence. And in those areas where he is conspicuous by his absence the humbler plants which demand less moisture hold undisputed sway and form the so-called grasslands. These herbaceous forms in turn may grow weary of the struggle in arid or semi-arid regions and a desert type, inhabited by only the most hardy or wholly destitute of vegetation, results.

I trust that before this the reader has grasped the idea of life and death competition between plants. Evolution has resulted in a bewildering array of plant forms, trees, shrubs, lianas, and herbaceous types with a concomitant crowding as a result. Force of circumstances has compelled these organisms to resort to mutual adjustments, to become plastic or adaptable as we say, and where a given set of environmental factors has been in force over a long period a plant "status quo" as it were, has resulted. In regions where circumstances such as drought and the like precluded tree growth, grasslands of various sorts occupy the terrain. On other areas, a climax forest consisting of stable tree citizens, found worthy by trial, has developed. In localities which permit the growth of forests, the climax forest is always the ultimate result of the working out of mutual adjustments and dependencies over a long period, sometimes of centuries. The primeval woods which originally covered the greater portion of New York State were in the main of this type but to the climax forest the advent of man is always a catastrophe. Civilization, with its demand for agricultural lands and forest products, chief among which is wood,

means the destruction of large areas of primeval forests. Nature sets about it promptly to heal the scars thus resulting, and if left to her own devices would ultimately again produce a climax type. But man impedes her at every turn either by preventing reforestation or, where forestry is practiced, by an arbitrary selection of the future forest citizens, that is, the trees. Nature's methods in the production of a climax forest when judged by financial standards, are neither economical or necessarily wise.

FACTORS GOVERNING DISTRIBUTION OF FORESTS

In general trees are impartial to soil unless the soil characters are of an extreme type. Relatively few have arbitrary soil requirements and their absence from given localities is not to be construed as resulting from the type of terrain but rather from competition due to other factors. Those trees which are most happily adjusted to their environments are bound to survive in the warfare of mutual adjustment owing to the advantage accruing from better growth conditions. It is only near the limits of its range that a species may become exacting as to soil, for here the balance which means the life or death of the organism is more delicately adjusted and an unfavorable soil may be sufficient to cause the elimination of a species from a given terrain.

Temperature is the potent factor in controlling tree distribution and results in forest belts which are determined, at least so far as their general contours are concerned, by latitude. No part of the earth is too hot to support forests, other factors being favorable, while the northern tree limit is believed to be fixed by a normal duration of temperature of 50° Fahr. for at least a month each year.* But the contour lines of forest belts are not of necessity east and west contours. Temperature fluctuates with altitude and with proximity to large bodies of water, that is, to oceans and large lakes. Mean annual temperature decreases with altitude. Large water areas tend to modify a climate owing to the fact that water cools and warms less rapidly than terrain. Added to the last is the effect of warm or cold ocean currents which sweep along the continental coasts. Doubtless supermaximum temperature fluctuations of brief duration and infrequent interval are potent factors in determining the limitations of species.

While temperature results in broad belts of vegetation of different types available moisture (precipitation, humidity, water

*R. DeC. Ward. Climate, 1908, page 28.

level, etc.), and terrain cause further modification of those types. It is generally conceded that the rainfall necessary for forest growth is about the same as that required for agriculture without irrigation, that is, from 20–24 inches. But precipitation is dependent on such physiographic features as (a) proximity to the ocean or other large bodies of water, (b) mountain ranges athwart the rain-bearing winds which necessitate a cooling of the air and heavier rainfall, and (c) location within or near the track of cyclonic storms. With equal temperature the kinds of trees and forest types vary with precipitation. This accounts largely for the fact that the Great Plains and the Great Basin of the United States are forestless though not treeless. The plant belts which owe their origin primarily to latitude are greatly modified in the United States owing to varying temperatures brought about by topography and by wide extremes in annual precipitation.

TRANSCONTINENTAL BELTS OR LIFE ZONES

In the development of the natural resources of the United States, particularly the agricultural resources, it was early recognized that North America contained seven transcontinental belts or life zones, each again divisible into a large number of minor floral-faunal areas. These zones, as defined by Merriam† are as follows:

I. *The Boreal Region*

1. The Arctic-Alpine Zone — The far north beyond the limit of tree growth and in the United States, high mountains above timber line. Zone of the polar bear, musk ox, reindeer and of arctic poppy, dwarf willow, etc., in north polar regions.

2. The Hudsonian Zone — Includes the northern part of the boreal conifer forest stretching from Labrador to Alaska. In eastern United States it is limited to the cold summits of the highest mountains from northern New England to western North Carolina.

3. The Canadian Zone — Includes the southern and most valuable part of the transcontinental boreal conifer forest in Canada and parts of Maine, New Hampshire and Michigan, extending southward along the Appalachian highlands to western North Carolina and Tennessee. Zone of red spruce, balsam fir, paper birch and mountain ash.

† Merriam, C. Hart. Life Zones and Crop Zones. U. S. Biol. Survey, Bull. 10, 1898.

II. *The Austral Region*

4. The Transition Zone — The eastern humid area, called the Alleghanian area. Includes the northeastern states and part of the Canadian provinces and the Alleghanies from Pennsylvania to Georgia. Zone of over-lap oak, chestnut, hickory, etc., with more northerly birch, beech, hemlock, sugar maple, etc.

5. The Upper Austral Zone — In eastern United States, the Carolinean area. From the lower Hudson and coastal region of New Jersey to the mouth of Chesapeake bay and westward and southward at moderate elevations. Zone of tulip-tree, hackberry, sweet gum, red bud, persimmon, etc.

6. The Lower Austral Zone — In eastern United States, the Austro-riparian area. The coastal plain from the mouth of Chesapeake bay to Florida and the other Gulf States westward. Zone of long-leaf and loblolly pines, bald cypress, live oak, magnolia and tupelo.

III. *The Tropical Region*

7. The tropical zone of southern Florida characterized by royal palm, mahogany, mangrove, etc.

DISTRIBUTION OF LIFE ZONES IN NEW YORK STATE

Bray * has ably discussed the distribution of life zones in New York State. I quote, viz.: "Applying New York to the temperature scale and having in mind latitude only our State would fall in the region rather between the zones where southerly or austral conditions give their impress and those where northerly or boreal conditions do it — in the Transition zone of Merriam. On a theoretical latitude and sea level basis, this State would scarcely enter the boreal forest zone of spruce, balsam and paper birch. But the actual climatic situation in New York is radically different from the theoretical one based on latitude and approximate sea level. This is in part due as mentioned previously to the influence of the ocean on the one hand and to the great lakes on the other, but more especially to elevation. In order to get the effect of elevation vividly in mind let us imagine the construction of relief features of New York on an approximately sea level foundation.†

* Bray, W. L. The Development of the Vegetation of New York State. N. Y. State College of Forestry, Tech. Pub. 3 : 50–51, 1915.

† Of course, this imaginary construction bears no intimation of actual geological processes which have shaped the present configuration of the State.

We construct a general plateau of say 2,000 feet elevation to 5,350 feet in the Adirondacks. Next we dissect this plateau down to the aspect of a hill and mountain land, cutting well defined streamways which converge to form the Delaware, Susquehanna and Alleghany drainage systems cutting into the plateau from the south. The Hudson-Champlain valley is a dissection to near sea level, cutting the State across from south to north. At the northwest we should plane down to fit the Ontario Lake basin, thus constructing the low, level plain bordering that lake and extending eastward as the Iriquois basin, including the Oneida Lake basin. The Mohawk is, then, a low and mostly broad valley a few hundred feet above sea level and joining the lake basin country with the Hudson valley. This cut severs the southern or Alleghany plateau from the Adirondacks. The lake basin country is continued around the north of the Adirondacks as a broad, low plain, the St. Lawrence valley. From the Iroquois-Ontario basin, cuts will be made into the Alleghany plateau constructing the Genesee drainage and the Finger Lake region of narrow north-south valleys opening out upon the lake basin plain. Finally, dissection of the Adirondack plateau would include sharply defined channels such as the Black, Oswegatchie, Raquett, Saranac, Ausable and Upper Hudson rivers and other masked or poorly established drainage features which may represent the effects of glacial filling.

"The extremes of climatic conditions as thus created, added to latitude and ocean influence factors, may be expressed by a contrast between Staten Island and the summit of Mount Marcy. Unfortunately, actual figures are not available for Mount Marcy, but so far as growing season is concerned, where absence of frost is taken as a criterion, the summit of Marcy would scarcely have any growing period at all for warm climate plants which reach their northern limit at the mouth of the Hudson, for it is doubtful if any month is wholly free from frost. Certainly the growing season for even the cold-resisting artic flora of the summit can scarcely exceed three months, while around New York bay the frostless period covers 200 days. But this doesn't express the full force of the difference between these two extremes. One should know the daily range of temperature in summer, which, of course, for the mountain summit, would be extreme. Again the lowest winter temperatures, the duration of zero or below zero temperature and so on.

"On Staten island are found such Austral plants as sweet gum, persimmon, mistletoe, willow oak, etc. On Mount Marcy, arctic species, such as *Diapensia lapponica, Rhododendron lapponicum* and a score of other species whose distribution is throughout the arctic regions of the three northern continents extending southward only on high mountains. This is much the sort of difference that one would get as between southern Illinois and Hudson bay. It supports the suggestion that within New York State there may be recognized a right wide range of floral provinces. But I wish to caution the reader against accepting without qualification the alleged facts of temperature effect as determined by elevation. Many of the phenomena of distribution will be found correlated with soil conditions, slope and exposure, local air drainage, etc., so that in reality the local edaphic conditions must be known."

We have seen that much of the terrain of New York State, more particularly the central plateau area, falls in the region where southern or Austral plants commingle with northern or boreal forms, that is, in the Transition Zone of Merriam. But the topography of the State and the proximity of certain parts of it to the ocean and the Great Lakes have brought about decided changes in zonal relations. For example, the dissection of the interior plateau by north-south drainage channels has led to a northern extension of Austral trees. This is especially well evinced in the Hudson Valley, where oak, chestnut and hickory persist more or less strongly, to Glens Falls and Whitehall, likewise in the drainage systems of the Delaware, Susquehanna and Alleghany rivers. The Great Lakes, owing to their ameliorating effect on climate, permit of the Austral flora along their southern shores. In the case of Lake Ontario this zone extends south into the Finger Lake region while the transition from Austral to Transition zone is abrupt south of Lake Erie owing to the more rugged topography. At higher altitudes in the Adirondacks and Catskills a more rigorous climate prevails and provides for a southern extension of the boreal vegetation of the Canadian zone in the form of islands surrounded by plateau lands, the chain of such islands being continued southward at increasing elevations in the Appalachians and providing, as it were, a north-south bridge for the extension of, or the persistence of boreal plants far to the south, in the last case laggards in the march of vegetation northward following glaciation.

In conclusion we may say that while — judged by latitude and theoretical temperature alone — the terrain of New York

State falls largely in the Transition Zone of Merriam, the distribution of life zones is locally and largely affected by topography, the potent factors of which are altitude and proximity to large bodies of water.

BRAY'S LIFE ZONES IN NEW YORK STATE

While Merriam's life zones serve in a rough way to delimit vegetational types in the main, it has been deemed wise by Bray * to describe more specifically zonal distribution of vegetation in the state and to carry Merriam's idea somewhat farther. Inasmuch as his treatment is both logical and convenient I have followed it with certain additions and subtractions of indicator species which seemed warranted from personal observation within the State. The life zones of New York State, as delimited by Bray, with arboreseent indicator species, are as follows: †

State Life Zones With Indicator Tree Species

A. Zone of Willow Oak, Sweet Gum, Persimmon, Etc.:

Indicator Species:

Short-leaf Pine	Pinus echinata Mill
Willow Oak	Quercus phellos L.
Post Oak	Quercus stellata Wang.
Black-jack Oak	Quercus marilandica Muench.
Laurel Magnolia	Magnolia virginiana L.
Sweet Gum	Liquidamber Styraciflua L.
Hop Tree	Ptelea trifoliata L.

In addition to these and others perhaps equally important, the species of Zone B and many of Zone C.

Distribution of A in New York

Staten Island, southern Long Island, especially coastward, and a narrow belt bordering the Sound from Manhattan and the Bronx to and continuing along the Connecticut coast. Growing period (estimated from last frost of spring to first of fall) 190 to 200 days

B. Zone of Dominance of Oaks, Hickories, Chestnut, Tulip-tree,

Indicator Species:

Red Cedar	Juniperus virginiana L.
Black Walnut	Juglans nigra L.
Cotton-wood	Populus deltoides Marsh.

* Loc. cit.
† See map, page 400.

Hickories:	
Bitternut. Swamp Hickory..	Carya cordiformis (Wang.) K. Koch.
Shag-bark. Shell-bark.....	Carya ovata (Mill.) K. Koch.
King-nut. Big Shagbark....	Carya laciniosa (Michx. f.) Loud.
Mocker-nut	Carya alba (L.) K. Koch.
Small-fruited Hickory	Carya microcarpa Nutt.
Pignut Hickory	Carya glabra (Mill.) Spach.
Sweet Birch	Betula lenta L.
Chestnut	Castanea dentata (Marsh.) Borkh.
Oaks:	
Red Oak	Quercus rubra L.
Swamp or Pin Oak.....	Quercus palustris Muench.
Scarlet Oak	Quercus coccinea Muench.
Gray Oak	Quercus rubra, var. ambigua (Michx. f.) Fer.
Black Oak	Quercus velutina Lam.
White Oak	Quercus alba L.
Mossy-cup. Burr Oak.....	Quercus macrocarpa Michx.
Swamp White Oak.....	Quercus bicolor Willd.
Rock Chestnut Oak.....	Quercus Prinus L.
Chestnut Oak or Yellow Oak.	Quercus Muhlenbergii Engelm.
Hackberry	Celtis occidentalis L.
Red Mulberry	Morus rubra L.
White Mulberry	Morus alba L.
Cucumber Tree. Mountain Magnolia	Magnolia acuminata L.
Tulip Tree. Yellow Poplar..	Liriodendron tulipifera L.
Papaw	Asimina triloba Dunal.
Sassafras	Sassafras variifolium (Salisb.) Ktze.
American Crab-apple	Pyrus coronaria L.
Wild Black Cherry.....	Prunus serotina Ehrh.
Sycamore	Platanus occidentalis L.
Red-bud	Cercis canadensis L.
Kentucky Coffee-tree.....	Gymnocladus dioica (L.) Koch.
Honey-locust	Gleditsia triacanthos L.
Flowering Dogwood	Cornus florida L.
Tupelo. Black Gum.....	Nyssa sylvatica March.
Great Laurel	Rhododendron maximum L.
Mountain Laurel	Kalmia latifolia L.
Black Haw	Viburnum prunifolium L.

Distribution of B in New York

Morainic region of Long Island and Staten Island; Hudson Valley region and adjacent highlands (Westchester hills, Highlands of the Hudson, Lower Catskills, especially dissected channels, e. g., Kaaters-kill Clove, becoming "thinned out" by disappearance of many species (Chestnut stops below Lake Champlain, Red Oak, White Oak, Shell-bark Hickory, Red Cedar and some others

extend up the Champlain valley to the St. Lawrence); the Delaware, Susquehanna and Alleghany drainage valleys; across the Alleghany plateau in Finger Lake valleys; up the Mohawk valley (especially south exposures) and notably strongly developed in the narrow Erie belt and the broader Ontario-Iroquois basis (notable occurrence of Chestnut on sandy soils) to the Oneida Lake region; northward "thinning out" (by disappearance of Chestnut, Tulip Tree, certain oaks and hickories and most of the secondary Austral woody species) toward the St. Lawrence valley.

Low elevations to more or less 1200 feet southward and in territory under maritime and especially lake influence.

Growing season 160 to 180 days (Lower Hudson region; Erie and Ontario basins). "Thinned out" at low elevations of 150 days growing season. (Apparent exception in case of Delaware, Susquehanna and Alleghany valleys?)

C. Dominance of Sugar Maple, Beech, Yellow Birch, Hemlock and White Pine Mixed Forest, Alleghany-Transition Forest Zone:

Indicator Species:

White Pine	Pinus Strobus L.
Hemlock	Tsuga canadensis (L.) Carr.
Black Willow	Salix nigra Marsh.
Peach-leaved Willow	Salix amygdaloides Anders.
Hop Hornbeam	Ostrya virginiana (Mill.) K. Koch.
Yellow Birch	Carpinus caroliniana Walt.
Blue Beech. Water Beech	Betula lutea Michx. f.
Gray Birch. Old Field Birch	Betula populifolia Marsh.
Beech	Fagus grandifolia Ehrh.
Juneberry	Amelanchier canadensis (L.) Medic.
Thorn-apple. Hawthorn	Crataegus pedicellata Sarg.
Choke Cherry	Prunus virgianiana L.
Sugar Maple	Acer saccharum Marsh.
Red Maple	Acer rubrum L. Notably in swamps.
Striped Maple	Acer Pennsylvanicum L. Zone D?
Mountain Maple	Acer spicatum Lam. Zone D?
Basswood	Tilia americana L.
White Ash	Fraxinus americana L.

Distribution of C in New York

Tendency to recurrence upon every favorable edaphic situation throughout the State up to more or less 2,000 feet (Catskills) excepting, in general, the Adirondacks, but dominant over the Alleghany plateau region and the Catskills below the spruce-balsam zone.

Frostless period in general 130 to 150 days.

More or less arbitrarily distinguished from the maple, beech, birch, hemlock-containing (and often dominated) Adirondacks and Catskills by absence (generally) of red spruce, balsam, white birch, etc., on the one hand and presence of certain species of Zone B which are lacking in the Adirondacks.

Similar extensions in mountains of New England, the Maritime Provinces and especially the St. Lawrence region of Quebec and Ontario (but peninsular Ontario is strongly like Zone B) and Michigan and Wisconsin.

D. Canadian-Transition Zone:

Dominance of maple, beech, yellow birch, hemlock, white pine as in Zone C, but addition and tendency to dominance in special situations and, especially at greater elevations, of red spruce, balsam, paper birch, mountain ash, etc. Further characterized by absence of oaks (few exceptions), hickories, elms, and, naturally, of tulip-poplar, chestnut, etc. (*i. e.,* dominant species of Zone B). Further, by the decreasing prominence of forest floor herbaceous growth-forms of the Appalachian region generally, and substitution of more northerly ranging species (see below).

Dominant tree species:

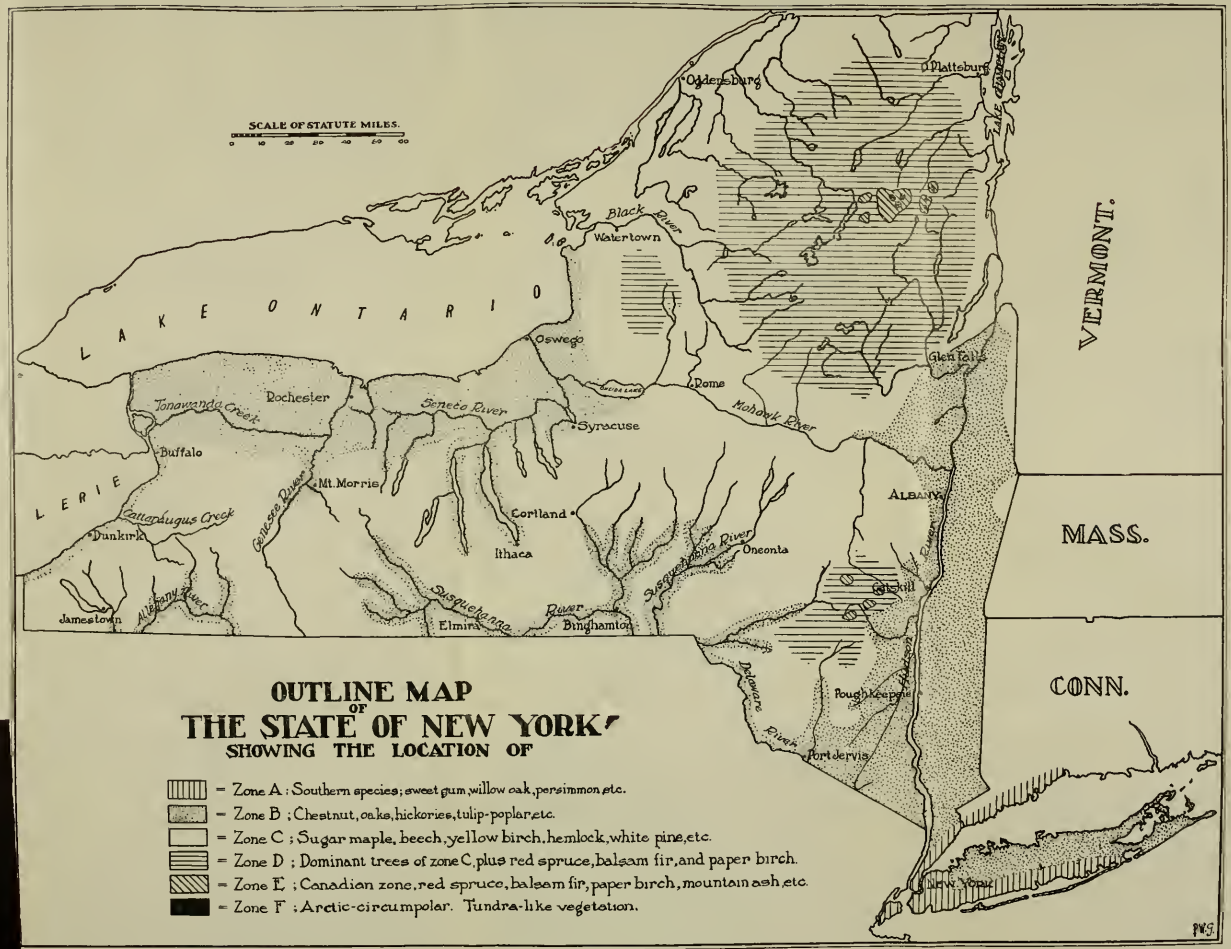
Red Spruce	Picea rubra (DuRoi) Dietr.
Black Spruce	Picea mariana (Mill.) B. S. P.
Balsam Fir	Abies balsamea (L.) Mill.
Pussy Willow, Glaucous Willow	Salix discolor Muhl.
Bebb's Willow	Salix rostrata Richards.
Mountain Ash	Pyrus americana (Marsh.) DC.

Distribution of D in New York

In the Catskills from about 2,000 feet to 3,700 feet (above which Canadian Zone forest is indicated by dropping out of maples, beech, hemlock and pine) and in the Adirondacks generally as climax forest up to 3,500 feet more or less.

Growing season 100 to 130 days, more or less.

* Bull. U. S. Dept. Agr. 55 : 1914. Forest Service Contribution.


SCALE OF STATUTE MILES.
0 10 20 30 40 50 60
LAKE ONTARIO
LAKE ERIE
Ogdensburg
Plattsburg
Lake Champlain
Black River
Watertown
Oswego
Rochester
Tonawanda Creek
Seneca River
Oneida Lake
Dome
Mohawk River
Glen Falls
Syracuse
Buffalo
Mt. Morris
Genesee River
Cortland
Ithaca
Susquehanna River
Oneonta
Albany
Hudson River
Catteraugus Creek
Dunkirk
Jamestown
Allegany River
Elmira
Binghamton
Catskill
Poughkeepsie
Delaware River
Port Jervis
New York
VERMONT.
MASS.
CONN.
OUTLINE MAP
OF
THE STATE OF NEW YORK
SHOWING THE LOCATION OF
= Zone A ; Southern species; sweet gum, willow oak, persimmon etc.
= Zone B ; Chestnut, oaks, hickories, tulip-poplar etc.
= Zone C ; Sugar maple, beech, yellow birch, hemlock, white pine, etc.
= Zone D ; Dominant trees of zone C, plus red spruce, balsam fir, and paper birch.
= Zone E ; Canadian zone, red spruce, balsam fir, paper birch, mountain ash, etc.
= Zone F ; Arctic-circumpolar. Tundra-like vegetation.
PWG

E. Canadian Zone. Dominance of Red Spruce, Balsam and Paper Birch:

Indicator Species:

Red Spruce	Picea rubra (DuRoi) Dietr.
White Spruce	Picea canadensis (Mill.) B. S. P.
Black Spruce	Picea mariana (Mill.) B. S. P.
Balsam Fir	Abies balsamea (L.) Mill.
Paper Birch	Betula alba, var. papyrifera (Marsh.) Spach.
Mountain Ash	Pyrus americana (Marsh.) DC.

Distribution of E in New York

Scarcely typical on summits of highest Catskills but indicated by dominance of red spruce and balsam, much somewhat dwarfed or gnarled-topped yellow-birch, and sparse paper-birch, and by forest-floor species. In the Adirondacks, the zone of spruce, balsam, paper-birch and mountain ash which succeeds maple, beech, birch, hemlock and white pine above 3,500 feet more or less, is here referred to the Canadian Zone which in its typical composition, as described by Cooper, is the Northeastern conifer forest *par excellence.* For general distribution of the Canadian forest type, see Map 3 in Zon's bulletin on balsam fir.*

F. Artic Flora of Adirondack Peaks:

Indicator Species — Devoid of arborescent forms. The following woody plants are indicative of this zone:

Fir Club Moss	Lycopodium Selago L.
Bearberry Willow	Salix Uva-ursi Pursh.
Glandular Birch. Scrub Birch	Betula glandulosa Michx.
Black Crowberry	Empetrum nigrum L.
Lapland Rose-bay	Rhododendron lapponicum (L.) Wahlenb.
Moss Bush	Cassiope hypnoides (L.) D. Don.

Distribution of F in New York

On the summit of Mt. Marcy above 5,000 feet; on Mt. McIntyre and to a less marked degree on Whiteface and others of the high Adirondack peaks.

General Distribution of F

On the higher peaks of New England where this arctic element is more strongly represented; in the arctic regions of America

* Bull. U. S. Dept. Agr. 55 : 1914. Forest Service Contribution.

(Labrador, Alaska), of Greenland and of Europe and Asia and high mountains of southeastern Asia; some of them in the Rocky mountains south to Colorado and in Arizona.

TREE RANGES VERSUS LIFE ZONES IN NEW YORK STATE

In concluding the discussion of the zonal distribution of vegetation in New York State and the distribution of trees within the State, it would be desirable to plot the range of each species upon a map of the State. This cannot be done, however, at the present time owing to a dearth of sufficient data covering areal development of the various trees within our borders. Particularly is this true in the case of naturalized forms which are still undergoing expansion and whose future range is yet more or less problematical. Under the circumstances it has seemed best to indicate the zonal distribution of each species by letter and to insert this information in the descriptive data accompanying each plate under "Range". Blackfaced type indicates relative abundance within the zone concerned, although not of necessity that the form is an indicator species.

DERIVATION OF THE NAMES OF TREES

By C. C. Forsyth *

LINGUISTIC SOURCES OF TREE NAMES

As a correlative to that section of the glossary devoted to the derivation of the names of trees, a brief review of the historical sequence of those languages in which these terms had their origin may not be out of place. Languages, like the trees themselves, have undergone a progressive evolution from the time when man first showed his superiority over the lower animals by designating the objects around him by specific sounds. At first these were few and cumbersome, but as new ideas were born he created new titles for them. In the end, he had a working vocabulary by which he could pass on to his off-spring the fund of knowledge which he had gained. Primitive man, forced as he was to secure a precarious living in a hostile forest, soon recognized that trees were not all similar and even while his store of facts was meagre he had singled out the more conspicuous representatives and had given them names. These articulate ideas in ever-changing form were transmitted from generation to generation, from tribe to tribe, and from age to age.

Often the mutation in nomenclature has been so great that all evidence of relationship to an earlier tongue has been lost, while in other cases the form has remained quite stable for a period of time antecedent to historical records. These words, among which there are many terms for plants, reveal much concerning primitive culture, migration of peoples, and contact with alien races.

As might readily be expected, much of our arborescent terminology is of Aryan derivation, and many of the words go back even to the parent Indo-European which is believed to have had its birth among the nomadic peoples inhabiting the level forest stretches of the Russian Steppes. From this point, pastoral hordes, encumbered with their flocks, extended in all directions. One group went south into Greece where they in time gave up the tribal state and built cities. In spite of their contact with the more advanced peoples to the southeast, they progressed along their own lines and were among the first of the Aryans to evolve a high civilization. They developed a written language which

* Assistant Professor of Wood Technology, New York State College of Forestry, Syracuse, N. Y.

has preserved for us numerous ideas which would have doubtless been lost if they had been forced to depend alone upon verbal inheritance. Another group went farther west into Italy, became Empire builders, and imposed their customs upon their less progressive neighbors. The Greeks reached a high plane as scientists, and to them we are indebted for much of our earliest botanical information. The Romans never attained as high a place as investigators. They were borrowers for the most part, and their chief influence is felt as missionaries whose duty it was to carry Hellenic culture and science to the corners of an extensive empire, as the progenitors of a lusty linguistic offspring in the present Romance languages, and as the standard-bearers of a high civilization and learning. The last group in which we are interested, the Germanic or Teutonic, spread through the north of Europe. They became subdivided into three main branches, the high German, the Norse (the Swedish, Danish, etc.), and the Low German, which became again divided into the Anglo-Saxon, the Dutch, and Scotch. To this last group we are beholden for a very large per cent. of the common names of trees.

With this brief review of the migrations of the Aryan races we may consider the origin of the names of a few trees which may throw some light upon man's early botanical knowledge, his migratory paths, and his contacts with other peoples.

As might naturally be supposed only a few of these names are sufficiently ancient to appear in the Sanskrit, or are distinctly similar in all the Aryan branches. Many of the trees with a more westerly range were, of course, unknown to the early nomads, others by their lack of striking features may have escaped notice, while the names of some may have been forgotten or unrecognizably changed during the vicissitudes of prolonged migrations, with their conquests and defeats.

The characteristic and widely distributed pine was doubtless well known long before the dawn of history since it is recorded in Sanskrit as pitu. In the Greek πίτυς, the name retains its ancient form, but becomes *Pinus* in Latin, pin in French, and pine in English. In its earlier form it may be allied to the word for pain. The peculiar white bark of the birch was perhaps responsible for its separation from the less spectacular trees, as the primitive Aryan called it bhurjas, from bhrja, to shine. One other going back to the Indo-Germanic, is daru, which means tree or larch. The Greek represents one of the most fertile of all fields owing in large part to a high scientific culture and a well developed

literature. Most of their names come to us through the Latin as has already been explained. Our word prune or plum has been derived from προυμνον or πρύνος through the Latin *Prunus.* Many names came into the Latin after contact was common, and the cultural Greek words may have supplanted an earlier Latin name for certain trees, among which φαγός, *Fagus;* μηλον, *Malus;* and πλάτανος, *Platanus,* may be mentioned. Others came as a result of trade often accompanied by an actual transplanting of the tree as in the case of ἀκακία, the *Acacia* from Egypt.

Those which are strictly Latin in form are rare, and doubtless represent those which were restricted to Italy or were sufficiently well known to withstand the Greek influence. Among this group *Quercus,* the Oak; *Abies,* the Fir; *Pyrus,* the Pear; and *Fraxinus,* the Ash, are examples. It is but natural that the extensive trade fostered by the Roman Empire should bring foreign trees to their knowledge, and *Persica,* the Peach, from the Persian pars, apparently came through the commercial route.

The Teutonic from which our own language was developed has furnished us with many common names, names originating after the separation from the Hellenic and Roman branches, but which had become so firmly rooted that they could not be replaced by the more cultural terms brought by their southern conquerors. Some of our best known words may be classified here, as for example, the Aspen, Ash, and Hawthorn. The restriction of these names to the common category is, of course, due to the early influence of the ecclesiastical Latin on literature and science.

A knowledge of many species came into England as a result of the Norman Conquest and later French influence. The Laurel from the Fr. laurier, through the M. E. laurer, the Mulberry from *mor,* through the M. E. mool, and the Sumach from *sumac,* indicate that the continental doubtless introduced into the British Isles those plants with which he had become acquainted by contact with the peoples to the south.

Very few names of trees are non-Aryan in origin, and one of the best examples is that of the Maple, and its earlier L. name *Acer* which is Celtic and may be a relic of the Roman occupation as may also be true of sal-lis *(Salix).*

Special incidents or changes in the lives of a people may exert no small influence on the language, and in this connection it may be well to mention two plants which came into England as a result of Christianity. Rose is a direct descendant of the L. *Rosa* from the Gr. ον; and the Lily, Gr. λείριον, comes from the same

sources, although cases are exceedingly rare where the words are of Semitic origin in spite of the influence of Hebrew on Christianity.

In new regions new trees are encountered and in many cases the aboriginal nomenclature is chosen as the technical, as in *Hicoria* from the Indian powchohiccora. In the same way *Tsuga* comes from Japan, while Hemlock is Anglo-Saxon and refers to species of the herbaceous *Cicuta.*

These very few and incomplete examples will show that no small amount of history is bound up in the names of trees, and those who are competent to make a real study of the problem may be able to clear up many disputed points as to prehistoric migrations, conquests, lines of trade, and other ethnological problems. Plants are especially well adapted to such a study both because primitive peoples know them, and because they have quite a definite distribution which may serve to geographically limit peoples or to tell from whence they came.

EXPLANATION OF TERMS USED IN THE GLOSSARY OF TREE NAMES

In a compilation of the etymological origin of any series of words, errors are likely to appear as divergence among authors bears testimony. The writer has in no case relied upon his own judgment, but, using the best sources available, has acted merely in an editorial capacity.

The following symbols and abbreviations have been used:

A. S.— Anglo-Saxon. The language of the Germanic invaders of England.
Ayran — Indo-European.
E.— English.
fr.— from an earlier source.
Fr.— French.
Ger.— German.
Gr.— Greek.
I. E.— Indo-European, the extinct parent tongue of the European and some Asiatic languages.
I. G.— Indo-Germanic — Indo-European.
L.— Latin.
L. L.— Late Latin.
M. E.— Middle English — the language of England fr. 1100–1500.
Skt. or Skr.— Sanskrit; the language of the early invaders of India which has been preserved in the Veda. It is believed to include more Indo-European derivatives than any other branch.
Sp.— Spanish.
Teut.— Teutonic, the parent language of the N. W. European group.
*— Akin to or of parallel descent from an earlier common source.

GLOSSARY OF DERIVATIONS

Abies — The L. common name for the European fir.

Acacia — fr. the Gr. *ἀκακία* the thorn tree of Egypt (fr. *ἀκίς* a thorn) through the L. *Acacia*. The common name of several species of the *Leguminosae*.

Acer — L. L. generic name for the maple. From the Celtic *ac*, hard, referring to the quality of the wood.

aceroides — L. (maple-like) from *Acer*, maple, and *oïdes* (like-see *amygdaloïdes*). The specific name of the old genus, *Negundo*.

acuminata — L. (sharp-pointed) fr. *acuminare*, to make sharp, referring to the sharp teeth on the leaves of *Quercus acuminata* (*Muhlenbergii*).

Aesculus — L. referring to the European "mast tree," (the L. common name) perhaps *Quercus Aesculus*.

Ailanthus — L. L. for "ailanto," the Chinese common name for the tree, and referring to the height in the native habitat.

allegheniensis — L. L. referring to the geographical habitat of *Betula lutea*.

alba — L. (white) a word allied to the Gr. *'ἀλφος* through the Sabine alpum, and referring to the white wood of *Carya alba*, and *Quercus alba;* to the white under surfaces of the leaves of *Salix alba*, and *Populus alba;* the white fruit of *Morus alba;* and to the glaucous foliage of *Picea alba* (*canadensis*).

alternifolia — L. (alternate-leaves) from *alter*, other, *-nus* (belonging to), and *-folium* fr. the Gr. *φύλλον*, leaf; referring to the apparently alternate leaves of *Cornus alternifolia*.

amara — L. L. (a trench or ditch) fr. the Gr. *ἀμάρα*, referring to the firm grooved bark or the slightly grooved petiole of *Carya minima*.

ambigua — L. (uncertain), referring to a northern variant of *Quercus rubra*.

Amelanchier — L. L. fr. the common name of a species in Savoy, of uncertain origin.

americana — L. L. (America) referring to the geographical habitat of several species.

amygdaloides — L. (like an almond) fr. the Gr. *ἀμύγδαλος* the almond, and *εἴδες* appearing like; referring to the peach-like or almond-like leaves of *Salix amygdaloides*.

Amygdalus — L. (the almond) fr. the Gr. *ἀμύγδαλος*, referring to a group of Asiatic trees among which are included *A. persica* (*Prunus Persica*) the peach, and *A. communis* (*Prunus Amygdalus*), the almond.

Apple — fr. the A. S. aepl — origin unknown, * in the Teutonic languages. The common name for *Pyrus Malus*.

Aralia — a generic name of unknown origin.

Arbor-vitae — fr. the L. *arbor*, tree; and *vitae* of life. The common name of *Thuja occidentalis*.

Ash — fr. the Teut. type askiz through the A. S. aesc. * in all Teut. languages. The common name of *Fraxinus*.

Asimina — an early Fr. name for the papaw, corrupted from the Algonquin, *rassimina*, sleeve-fruit.

Aspen — (asp & en — an adj. ending as wood-en) fr. the A. S. aespe. * in Teut. langnages. The common name for *Populus*.

atropunicea — L. (dark brown) from *ater*, brown, and *punicea*, yellow, referring to the color of the autumn leaves of *Fagus atropunicea* (*grandifolia*).

Aucuparia — L. (relating to bird catching) from *aucupium*, bird-catching, referring perhaps to the tendency of the birds to feed upon the fruit of *Pyrus Aucuparia*.

aurantiac — L. (resembling the orange) fr. the Skr. naranga, the orange; referring to the similarity of the leaves of *Maclura pomifera* to those of the orange, and to the size of the fruit.

avium — L. (out of the way) fr. *a-* out of, and *via*, way; referring perhaps to the habitat of the European *Prunus avium;* perhaps a variant of the L. *avis*, bird, since birds frequently feed on the fruit of this species.

babylonica — L. (Babylon) through the Gr. *βαβίλων*; referring to the origin of *Salix babylonica*.

Balm of Gilead — fr. the L. *balsamum* (see *balsamea*) through the Fr. basme and the M. E. balm & Gilead (?) The common name of *Populus candicans.*

Balsam — fr. the *L. balsamum* (see *balsamea* and balm). The common name of *Abies balsamea.*

balsamea — L. (the balsam tree) fr. the (semetic [Heb.] *balsam*) through the Gr. *βάλσαμον* and the L. *balsamum.* Referring to the resinous character of the bark of some oriental species. Here referring to the resinous pockets in the bark of *Abies balsamea.*

balsamifera — L. (balsam-bearing) fr. *balsamum,* resin, and *ferre,* to bear, referring to the resinous character of *Populus balsamifera.*

Banksiana — L. L. for the surname, Banks.

Bass — fr. the A. S. baest and E. bast. Of unknown origin * the Germanic. The common name of *Tilia.*

Bay — fr. the L. *bacca,* a berry, through the Fr. baie. The common name of species of Laurus owing to the fruit, and of *Salix pentandra* owing to the laurel-like leaves.

Bebbiana — L. L. for the surname, Bebb. A name given to *Salix rostrata.*

Beech — fr. the I. G. bhagos, a tree with edible fruit; through the A. S. bece, and the M. E. beech, * the Gr. *φηγός* and the *L. Fagus,* which see. The common name of *Fagus.*

Betula — L. for the common Latin name of the birch tree, a word allied to the Skt. bhurja. to shine, referring to the shiny character of the bark.

bicolor — L. (two-colored) fr. *bis-,* twice or two, and *color,* color; referring to the green upper and whitened lower surfaces of the leaves of *Quercus bicolor.*

bignonioides — L. L. (Bignonia-like) fr. *Bignonia,* a tree named for Abbé-Bignon, and *oïdes,* like. A specific name given to *Catalpa Catalpa,* and referring to similarity of the flowers to those of *Bignonia.*

Bilstead — origin(?). The common name of *Liquidambar Styraciflua.*

Birch — fr. the Skt. bhuria, fr. *bhrja* — to shine, through the A. S. birce and the M. E. birche * to the Aryan series. See *Betula,* the common name of *Betula.*

blanda — L. (smooth); referring to the smooth, silky leaves of *Salix alba.*

borealis — L. (pertaining to the north) fr. the Gr. *βορέας* God of the north winds; referring to the northern habitat of *Quercus borealis* (*rubra, var. ambigua*).

Box elder — Box fr. the Gr. *πύξος,* through the *L. buxus,* the box wood, *Buxus sempervirens* and the A. S. box, and elder which see. The common name of *Acer Negundo* owing to the hardwood (?) and elder-like leaves.

Broussonetia — L. L. for the surname, Brussonet. A generic name given in honor of the naturalist, Auguste Brussonet.

Butternut—Butter fr. the Gr. *βους,* ox and *τύρος,* cheese, through the L. *butryum* and Nut fr. the A. S. hnutu through the M. E. nut, * the Teutonic group. The common name of *Juglans cinerea* owing to the oily fruit.

canadensis — L. L. referring to the geographical habitat of several species.

canina — L. (a dog's skin), referring to the peculiar ridged bark of *Celtis occidentalis.*

caroliniana — L. L. (Carolina), referring to the geographical habitat of several species.

Carpinus — L. The common Latin name for the hornbeam.

Carya — L. L. fr. the Gr. *καρία* (form of *κάρῡνον,* the skull); referring to the skull-like fruit of the genus.

Castanea — L. (the chestnut) fr. the Gr. *κάστανον,* perhaps named for a city in Pontus, *καστανία,* a word, perhaps related to the Armenian, kaskeni, the chestnut tree. The common name comes from this through the Fr. chastigna.

Catalpa — L. L. from the Cherokee common name catawba. The tree was discovered by Catesby in 1728.

cathartica — L. (a purgative) fr. the Gr. *καθαρώ,* to cleanse, through *καθρτικὸς,* referring to the cathartic properties of *Rhamnus cathartica.*

Cedar — fr. the Gr. *κέδρος* through the L. *Cedrus* and the A. S. cedar. The common name of several of the *Cupressineae.*

Celtis — A name given by Pliny to the African lotus, and later transferred to the genus owing to the sweet quality of the fruit.

Cerasus — The old L. name for the cherry tree fr. the Gr. *κεράσος*, a tree brought by Lucullus from Asia Minor.

Cercis — L. L. fr. the Gr. *κερκίς*, the ancient name for the Judas tree.

Chamaecyparis — L. (low-cypress) fr. the Gr. *χαμαί*, on the ground, and *κυπάρισσος*, the cypress.

Cherry — fr. the Gr. *κεράσος* through the L. *Cerasus* (which see), the O. F. cerise, and the M. E. chery. The common name of *Prunus*.

Chestnut — fr. the Gr. *κάσταο* through the L. *castanea* (which see), the Fr. chastaigne and the M. E. chestein, chesten-nut (see Butternut). The common name of *Castanea*.

Chinquapin — fr. the N. Am. Indian word for *Castanea pumila*, and those species of *Quercus* with chestnut-like leaves.

cinerea — L. (ash-colored) fr. the Gr. *κονίς*, through the L. *cinis*, or dust; referring to the color of the bark of *Juglans cinerea*.

coccinea — L. (scarlet or crimson) fr. *coccum*, a gall growing on *Quercus coccifera* which was used in making red dyes. (?) The word comes from the Gr. *κόκκος*, a seed or berry; referring to the scarlet autumn leaves of *Quercus coccinea*.

Coffee-tree — fr. the Arabic quahweh through the Turkish cauphe; and tree fr. the Skt. daru, wood; or daru, pine wood, through the Teut. trewom and the A. S. treo * the Teutonic group, the Gr. *δρυς*, oak; *δόρυ*, a spear shaft, the Irish darog, the Russ. drevo, and the Philippine durog (?), a spear. The common name of *Gymnocladus dioica* owing to the coffee-like seeds.

communis — L. (common) fr. *com-munis*, ready-to be of service, referring to a general and abundant distribution of several species.

copallina — L. L. fr. the Mex. copal, the name of a white resin from a species of *Rhus* in Mexico, referring to the latex in the bark of *Rhus copallina*.

cordiformis — L. (heart-shaped) fr. the Gr. *καδία*, through the L. *cor*, heart, and *forma*, shaped, referring to the shape of the fruit or the base of the leaflets of *Hicoria minima* (*Carya cordiformis*).

Cornel — fr. the L. *cornus* (which see) through the L. L. *cornolium*. The common name of *Cornus*.

Cornus — The L. common name for the cornel fr. *cornu*, horn; referring to the hardness of the wood.

coronaria — L. (that which serves to make crowns) fr. *coronare*, to crown. This term may refer to the custom of making wreaths from the leaves of *Pyrus coronaria*.

Cotton wood — cotton fr. the Arabic qutn through the Sp. coton, the Fr. coton, and the M. E. cotoun & wood — fr. the A. S. wudu through the M. E. wode, * the Teutonic and Galic where it refers to a tree. The common name of *Populus deltoides* owing to the comose seeds.

Crabapple — crab fr. the M. E. crabbe, implying poor quality and apple (which see). The common name of *Pyrus coronaria* owing to the poor quality of the fruit.

Crataegus — L. (the hawthorn) fr. the Gr. *κραταίγος*, a word derived from *κράτος*, strength, owing to the hardness of the wood of the genus.

Cucumber tree — cucumber fr. the L. *cucumis*, a name referring to the process of ripening by heat, fr. *coquere*, to cook; through the M. E. cucumer (cucumber) and tree (see coffee-tree). The common name of *Magnolia acuminata* owing to the shape of the fruit.

Cupressus — L. (cypress) fr. the Gr. *κυπόρισσος*; a word of earlier Semetic origin.

Cypress — fr. the L. *cupressus* through the Fr. and M. E. cipres. See *Cupressus*. The common name of *Taxodium distichum* owing to the similarity of the cones to those of *Cupressus*.

dasycarpum — L. (thick-fruit) fr. the Gr. *δασύς*, thick, and *καρπός*, seed; referring to the fruit of *Acer saccharinum* (?).

Datisca — L. L. of unknown origin given as a synonym for *Rhus*.

deltoides — L. (like the letter D), from the Gr. *σέλτα*, D and *οϊδες*, like, referring to the leaves of a *Populus deltoides*.

dentata — L. (having teeth) fr. *dens*, a tooth, referring to the dentate margins of the leaves of *Castanea dentata*.

dioica — L. L. (two-houses) fr. the Gr. *δίς-*, two, and *οἰκία*, house, referring to the dioecious or polygamous flowers of *Gymnocladus dioica*.

Diospyros — L. L. for the genus, fr. the Gr. *Δίος*, a God, and *πυρός*, wheat or grain. According to Sargent this term refers to the life-giving properties of the fruit of the genus.

discolor — L. (two-colored) fr. *dis-*, two, and *color*, color, referring to the difference in color of the upper and lower surfaces of the leaves of *Salix discolor*.

divaricata — L. (spread apart) fr. *dis-*, apart or two, and *varicare*, to spread, referring to the spreading branches of *Pinus divaricata* (*Banksliana*).

domestica — L. (domestic) fr. *domus*, house, referring to the cultivation of *Prunus domestica*.

echinata — L. (covered with spines) fr. the Gr. *ἐχῖνος*, through the L. *echinus* (a hedgehog or sea urchin, hence a spine) and the suf-*atus*, covered with; referring to the armed cones of *Pinus echinata*.

Elder — fr. the A. S. ellaern * the Germanic i. e. Ger. ahorn, maple. Allied to the word hollow in reference to the hollow twigs. The common name of *Acer Negundo*.

Elm — fr. the A. S. elm * the Ger. Ulm and the L. *Ulmus* (which see). The common name of *Ulmus*.

Fagus — L. (the beech) fr. the Gr. *φαλειν*, to eat, through the Dorian *φαγός*, the beech, in reference to the edible fruit of the genus.

ferruginea — L. (rusty) fr. *ferrum*, iron, through *ferrugo*, rust; referring to the brown autumn leaves of *Fagus ferruginea* (*grandifolia*).

Fir — fr. the Ger. Forha through the A. S. furu, perhaps of Scandanavian origin * the Teutonic group. The common name of *Abies*.

florida — L. (abounding in flowers) fr. *flos*, a flower; referring to the showy inflorescence of *Cornus florida*.

Foleyana — L. L. fr. the surname Foley. A synonym for *Salix purpurea*.

fragilis — L. (fragile) fr. *fragnere*, to break; referring to the easily broken branches of *Salix fragilis*.

Fraxinus — L. The L. common name of the ash tree.

fulva — L. (tawny, yellow, or reddish); referring to the color of the inner bark of *Ulmus fulva*.

glabra — L. (smooth), referring to the smooth leaves of several species.

glandulosa — (full of glands or fruit) fr. *glans*, a nut or gland and *-osus*, full of; referring to the abundance of fruit, or the glandular leaflets of *Ailanthus glandulosa*.

glauca — L. (bluish) fr. the Gr. *γλαυκός*, referring to the glaucous undersurfaces of the leaves of *Magnolia glauca*.

Gleditsia — L. L. for the surname of Gleditsch, and named for J. G. Gleditsch, a contemporary of Linnaeus.

Grandidentata — L. (large-toothed) from *grandis*, large, and *dentatus*, toothed (see *dentate*), referring to the large dentations on the leaf margins of *Populus grandidentata*.

grandifolia — L. (large leaf) fr. *grandis*, large, and *folium*, leaf; referring to the size of the leaves of *Fagus grandifolia*.

Gum — fr. the Egyptian kami, through the Gr. *κόμμι*, the L. *gummi*, the Fr gomme, and the M. E. gomme; referring to the hardened juices of certain trees. The common name of species of *Nyssa* and *Liquidambar Styraciflua* owing to gummy exudations.

Gymnocladus — L. L. (naked branches) from the Gr. *γυμνός*, naked, and *κλάδος*, branch; referring to the sparse foliage or the large, leafless branches in winter condition.

Hackberry — hack = hag-berry (see hawthorn) and berry (see mulberry). The common name of *Celtis occidentalis*.

Hackmatack — fr. the N. Am. Indian, hakmantak, Belknap — Hist. of N. H. III; "On some mountains wo find a shrubbery of hemlock and spruce, whose branches are knit together so as to be impenetrable. The snow lodges on their tops, and a cavity is formed underneath. These are called by the Indians, 'hackmantaks'." Transferred as the common name of *Larix laricina*.

Hawthorn — haw — fr. the A. S. haga, an enclosure or hedge * to the Teutonic group, perhaps fr. *hagon*, an enclosure and thorn fr. the Skt. trna, a blade of grass, through the A. S. porn, a sharp point * Teutonic group. The common name of *Crataegus* owing to its use for hedges.

Hemlock — fr. the A. S. hemlock, a name referring to species of *Cicuta*. An earlier common name was hemlock-spruce. The common name of *Tsuga canadensis* owing to the resemblance of its foliage to the dissected leaves of *Cicuta*.

heterophylla — L. (variously formed leaves) fr. the Gr. *ἕτερος*, different, and *φύλλον*, leaf; referring to the leaf-form of *Tilia* and *Populus heterophylla*.

Hickory — fr. *hicoria*, which see.

Hicoria — L. L. fr. the Indian powcohiccora; referring to the custom of securing a milk from the pounded nuts.

Hippocastanum — L. (horse-chestnut) fr. the Gr. *ἵππος*, horse, and *κάστανον* chestnut (see *Castanea*); referring to the size of the fruit of *Aesculus Hippocastanum*.

hirta — L. (hairy); referring to the woolly branches of *Rhus typhina*.

Holly — fr. the A. S. holen through the M. E. holyn. Perhaps from the Teut. kolenno * to the Celtic. The common name of *Ilex*.

Hornbeam — horn — fr. the A. S. horn * to the Aryan group. (See Cornus), and beam fr. the A. S. beam, a tree, the Teutonic, i. e. the Ger. baum. The common name of *Ostrya* and *Carpinus* owing to the hard wood.

Ilex — L. (holly) the L. common name of the holly oak, *Quercus Ilex;* referring to the resemblance of the leaves to those of this species of oak.

imperialis — L. belonging to an empire, fr. *imperium*, an empire. The specific name of *Paulownia imperialis* (*tomentosa*.)

inops — L. (destitute) fr. *in-*, without, and the Gr. *ὄψις*, appearance; referring to the tendency of *Pinus virginiana* to thrive on poor soils. (?)

Judas tree — Judas fr. the Heb. Judas since Judas is said to have hanged himself from a limb of *Ceris siliquastrum*, and tree (see coffee-tree). The common name of *Cercis*.

Juglans — L. (walnut or the nut of Jupiter), the old L. common name fr. *Jupiter*, and *glans*, nut.

Juniper — fr. the L. *Juniperus*, which see. The common name of *Juniperus*.

Juniperus — L. (Juniper), of doubtful origin.

Kalmia — L. L. for the surname Kalm, and referring to Peter Kalm, a student of Linnaeus, who visited America.

laciniosa — L. (full of plates) fr. the Gr. *λάκις*, the flap of a garment, and *-osus*, full of; referring to the shaggy bark of *Carya laciniosa*.

Larch — fr. the Skt. daru, a tree, through the L. *Larix*, which see. The common name of *Larix*.

laricina — L. (pertaining to the larch) fr. *Larix*, the larch.

Larix — The L. common name for the larch, fr. the Skt. daru through the Gr. *λάριξ*. The common name, "larch" comes directly from this word.

latifolia — L. (broad leaf) fr. *latus*, broad, and *folium*, leaf; referring to the broad leaves of *Kalmia latifolia*.

Laurel — fr. the L. *Laurus*, a laurel-tree, through the Fr. laurier and the M. E. laurer. The common name of *Kalmia* and *Rhododendron* owing to their similarity to *Laurus*.

laurifolia — L. (laurel leaf) fr. *Laurus*, laurel, and *folium*, leaf; referring to the shining leaves of *Salix pentandra* and *Quercus phellos*.

lenta — L. (limber, tough, or supple); referring to the character of the branches of *Betula lenta*. (?) Perhaps * the I. G. lent, see Linden.

Lentago — L. perhaps from the European *Lentana*, fr. the L. *lentus*, limber, and so referring to the supple branches of *Virburnum Lentago*. (?)

Lime — see Linden.

Linden — Lind-en (see aspen), lind, line, or lime tree all of which are fr. the I. G. lent through the A. S. lind and Teut. lenda * the Aryan group i. e. the Gr. *ἐλάτη*, a fir tree. The common name of *Tilia*.

Liquidambar — L. (liquid-amber) fr. *liquere*, to be liquid, and the Arab. ambar, an allusion to juices exuding from this tree.

Liriodendron — L. (lily-tree) fr. the Gr. *λείριον*, lily, and *δένδρον*, tree; referring to the showy flowers of the genus *Liriodendron*.

Locust — prob. fr. the L. *locusta*, the insect-locust. The common name of several of the *Leguminosae* owing to the character of the flowers.

lucida — L. (bright or shining) fr. *lux*, light through lucere, to shine; referring to the shining leaves of *Salix lucida*.

lutea — L. (pale yellow) fr. lutum, mud or clay; referring to the color of the bark of *Betula lutea*.

Maclura — L. L. for the surname Maclure, and named for Wm. Maclure, the American geologist.

macrocarpa — L. L. (large-fruit) fr. the Gr. *μακρός*, large, and *καρπός*, seed, from *κάρφω* to dry; referring to the large acorns of *Quercus macrocarpa*.

Magnolia — L. for the surname Magnol, and named for Peter Magnol, Professor of Botany at Montpelier, in the 17th century.

Mahaleb — direct from the Persian. The fruit of the tree was used in the manufacture of perfumes. This common name became the specific name of *Prunus Mahaleb*.

Malus — L. (apple) the common name fr. the Gr. *μῆλον* through the Doric *μᾶλον*.

Maple — fr. the A. S. mapul, perhaps allied to the Ger. masshold. The common name of *Acer*.

mariana — the specific name of *Picea mariana*. (?)

marilandica — L. L. (Maryland); referring to the geographical habitat of *Quercus marilandica*.

maximum — L. (largest) sup. of *magnus*, large; referring to the size of *Rhododendron maximum*.

Mazzard — fr. O. H. G. masar, a knot or maple wood, through the Fr. maser and the M. E. maser. The common name of *Prunus avium*.

Michauxii — L. L. for the surname Michaux; referring to Francois Michaux, the botanist. Name given to *Quercus* and *Tilia Michauxii*.

microcarpa — L. (small seed) fr. the Gr. *μικρός*, small, and *καρπός*, seed; referring to the small seeds of *Carya microcarpa*.

minima — L. (smallest) sup. of *minor*, small; used as a synonym for *Carya cordiformis*.

minor — L. (small) referring to the small stature of *Quercus minor* (*stellata*).

mitis — L. (pliant or weak) referring to the flexible spines on the cones of *Pinus echinata*. (?)

monilifera — L. (necklace bearing) fr. *monile*, a necklace, and *ferre*, to bear; referring to the pendulus aments of *Populus monilifera* (*deltoides*).

Mocker nut — The common name of *Carya tomentosa*. (The word mocker may refer to a similarity of the fruit to that of *Carya ovata*.)

Morus — L. (the mulberry) fr. the Gr. *μόρεα*.

Muhlenbergii — L. L. for the surname Mühlenberg, named for G. H. E. Mühlenberg.

Mulberry — fr. the L. *Morus*, which see, through the Fr. mor, and the M. E. mool, and berry fr. the Skt. bhas, to eat, through the A S. berge. The common name of *Morus*.

multiflora — L. (many-flowered) fr. *multus*, many, and *flos*, flower; referring to the flower heads of *Nyssa multiflora* (*sylvatica*).

Negundo — L. L. from the Malayan common name of *Vitex negundo*, and transferred as a generic name for *Acer Negundo*, and later as the specific name.

nigra — L. (black); referring to the color of the wood of *Juglans nigra*, the dark leaves of *Picea mariana*, and the bark of *Quercus marilandica*.

Nyssa — L. L. fr. the Gr. *νυσα*, a tree named for Bacchus' nurse, and used by Linneaus to signify that the tree grew near the water.

Oak — fr. the Teut. aiks through the A. S. ac, and the M. E. oke, * the Aryan group, i. e., the Gr. *αἰγ-ίλωψ*, an oak tree. The common name of *Quercus*.

obtusifolia — L. (blunt-leaf) fr. *obtundere*, to blunt, and *folium*, leaf; referring to the rounded leaf lobes of *Quercus minor*.

occidentalis — L. (western) fr. *occidere*, to go down. Name given by Linnaeus to *Thuja* — and *Celtis occidentalis*.

odorata — L. (fragrant) fr. the Gr. *ὀδωδή*; referring to the fragrant foliage of *Carya microcarpa*.

officinale — L. (a drug) fr. *officina*, a work shop, now referring to anything kept by druggists and applied to the medicinal properties of *Sassafras Sassafras* (*variifolium*).

opaca — L. (dark or opaque), referring to the dull green leaves of *Ilex opaca*.

Osage orange — fr. the tribal name of the Osage Indians — one of the Siouan tribes, and orange fr. the Skt. naranga through the L. *aurantium*,— see *aurantiaca*. The common name of *Maclura pomifera* owing to the large, orange-like fruit.

Osier — fr. the L. L. *osaria*, a bundle of willow twigs, through the Fr. osier and the M. E. osyere. The common name of *Salix*.

Ostrya — L. (hornbeam). fr. the Gr. *ὀστρία*, the Gr. common name for the tree.

ovata — L. (ovate or egg-shaped) fr. the Gr. *ωόν*, an egg, through the L. *ovum;* referring to the ovate leaflets of *Carya ovata*.

palustris — L. (boggy) fr. *palus*, swamp; referring to the low-land habitat of *Quercus palustris*.

Papaw — fr. the Carib. ababai, through the Cuban papaya, the Sp. papaya and the E. papaw (pawpaw). The common name of *Asimina triloba*.

Paper-mulberry — fr. L. *papyrus* (see *papyrifera*) through the Fr. papier and mulberry, which see. The common name of *Broussonetia papyrifera* owing to the utilization of the bark for paper.

papyrifera — L. (paper-bearing) fr. the Egyptian word for a reed used in making paper and coming through the Gr. *παπῦρος*, and *ferre*, to bear; referring to the papery bark of *Betula alba, var. papyrifera*.

Paulownia — named for the Russian princess Anna Pavlovna, dau. of Paul I.

Peach — fr. the Pers. pars through the L. *persicum*, which see, the Fr. pesche, and the M. E. peche. The common name of *Prunus Persica*.

Pear — fr. the L. *pĭrum* or Pyrus, which see, through the A. S. peru and the M. E. pere. The common name of *Pyrus communis*.

pendula — L. (drooping) fr. *pendere*, to hang; referring to the drooping branches of *Salix babylonica*.

pentandra — L. (five-stamens) fr. the Gr. *πέντε*, five, and *ἀνδρός*, of the male; referring to the number of stamens of *Salix pentandra*.

Pepperidge — fr. the E. dial. word for the barberry. An early common name of *Nyssa sylvatica*.

Persica — L. (peach) fr. the Persian pars. This is the Plinean name for the peach.

Persimmon — fr. the Va. Indian word or the Algonquin pasimine in reference to the drying of the fruit fr. *pas*, to be dry. The common name of *Diospyros virginiana*.

Phellos — L. (cork) fr. the Gr. *φέλλος*, cork, perhaps referring to *Quercus suber*. The word also applies to stony, barren ground which produces a pumice used as a substitute for cork on fish nets. The name was transferred to *Quercus Phellos*.

Picea — L. (pine) fr. the Gr. *πίσσα*, pitch, through the L. *pix*. Transferred as the generic name for the spruce.

Pine — fr. the L. *Pinus*, which see, through the A. S. pin. The common name of *Pinus*.

Pinus — L. (pine) fr. the Skt. pitu through the Gr. *πίτυς*.

Plane — fr. the Gr. *πλάτανος* through the L. *Platanus* which see, the Fr. and M. E. plane. The common name of *Platanus* owing to the spreading branches and broad leaves.

platanoides — L. (sycamore-like) fr. the Gr. *πλάτανος*, the plane tree, and *oïdes*, like; referring to the broad leaves of *Acer platanoides*.

Platanus — L. (the sycamore) fr. the Gr. *πλάτανος*, broad; referring to the broad leaves and crown of the European species.

Plum — fr. the Gr. *προυμνον* through the L. *Prunus* which see, the A. S. plume (a change of r to l is not uncommon). The common name of species of *Prunus*.

pomifera — L. (apple-bearing) fr. *pomum*, the apple, and *ferre*, to bear, referring to the large fruits of *Maclura pomifera*.

Poplar — fr. the L. *Populus*, which see, through the O. F. poplier and M. E. poplere. The common name of *Populus*.

populifolia — L. (poplar-leaf) fr. populus, poplar, and *folium*, leaf; referring to the shape of the leaves of *Betula populifolia*.

Populus — L. (poplar) the L. common name for the genus.

porcina — L. (pertaining to pigs) fr. *porcus*, a pig; referring to the use of the fruit of *Carya glabra* as food for hogs.

Prinus — L. fr. the Gr. *πρίνος*, the ancient name of some evergreen tree, perhaps *Quercus Ilex*, transferred to *Quercus Prinus*.

prunifolium — L. (plum-leaf) fr. *Prunus*, plum, and *folium*, leaf; referring to the shape of the leaves of *Viburnum prunifolium*.

Prunus — L. (plum-tree) fr. the Gr. *πρίνος*, the common name for the plum tree.

Pseudoacacia — L. (false-acacia) fr. the Gr. *ψευδος*, a falsehood, and *ἀκακία*, the acacia, a thorn tree of Egypt; referring to the similarity of the genus *Acacia* to *Robinia Pseudoacacia*.

Ptelea — L. L. fr. the Gr. *πτελέα*, the elm, from *πτέρον*, wing; referring to the winged fruit of the elm, and *Ptelea*.

pubescens — L. (having hair) fr. *pubescere*, to grow hair; referring to the hairy organs of several species.

purpurea — L. (purple); referring to the color of the branches of *Salix purpurea*.

Pyrus — L. (the pear). The L. common name for the pear.

Quercus — L. (oak) fr. the L. common name of the genus.

racemosa — L. (full of clusters) fr. *racemus*, clusters and *-osus*, full of; referring to the racemose fruit of *Ulmus racemosa*.

resinosa — L. (full of resin) fr. the Gr. *ῥητίνη*, resin, and *-osus*, full of; referring to the resinous quality of the wood and bark of *Pinus resinosa*.

Rhamnus — L. L. (the buckthorn) fr. the Gr. *ῥάμνος*, the common name of the genus.

Rhododendron — L. fr. the Gr. *ῥόδον*, a rose, and *δένδρον*, a tree; referring to the showy flowers of the genus.

Rhus — L. (the sumach) fr. the Gr. *ῥοῦς*, from *ῥέω*, to flow, the common name of the genus.

rigida — L. (stiff) fr. *rigere*, to be stiff; referring to the rigid habit of *Pinus rigida*.

Robinia — L. for the surname of John Robin, herbalist to Henry IV, of Fr., who was first to cultivate the tree in Europe.

rostrata — L. (beaked) fr. *rodere* to gnaw, through *rostrum*, the beak of a ship; referring to the long attenuate fruit of *Salix rostrata*.

rubens — L. (reddish) fr. *rubere*, to be red; referring to the *color* of the foliage or cones of *Picea rubens* (*rubra*).

rubra — L. (red); referring to the color of the wood of *Quercus rubra*, and other species.

Russelliana — L. for the surname Russell. A synonym for *Salix fragilis*.

saccharinum — L. a. (sweet) fr. *saccharum*, sugar; referring to the sweet sap of *Acer saccharinum*.

saccharum — L. (sweet or sugar) fr. the Skt. çarkara through the Gr. *σάκχαρον*; referring to the sweet sap of *Acer saccharum*.

Salix — L. (willow) fr. the common name of the willow.

sambucifolia — L. (elderberry-leaf) fr. the Semetic sabbka, a musical instrument, through the Gr. *σαμβύκη* and *φύλλον*, leaf; referring to the elder-like leaves of *Fraxinus nigra*.

Sassafras — L. L. perhaps from the early Indian name.

sativa — L. (pertaining to planting); referring to the seeds of *Castanea dentata*.

serotina — L. (that which ripens late); referring to the late flowering of *Prunus serotina*.

Sorbus — L. (the service tree) given as a generic name for the Mountain Ash.

speciosa — L. (ornamental) fr. *specere*, to observe, through *species*, appearance, and *-osus*, full of; referring to the showy flowers of *Catalpa speciosa*.

sphaeroidea — L. (spherical) fr. the Gr. *σφαῖρα*, sphere, and *οἰδες*, like; referring to the globular cones of *Chamaecyparis thyoides*.

spicatum — L. (shape-pointed) fr. *spica*, a spine or ear of corn; referring to the steeple-like inflorescences of *Acer spicatum*.

spinosa — L. (full of thorns) fr. *spina*, a thorn, allied to *spica*, an ear of corn, and *-osus*, full of; referring to the cortical spines of *Aralia spinosa*.

Spruce — fr. the Ger. Pruse, "so named because it was first known as a native of Prussia, or because its sprouts were used in making spruce beer." Tho common name of *Picea*.

stellata — L. (covered with stars) fr. the Skt. star; referring to tho radiate lobes of *Quercus stellata* (*minor*).

Strobus — L. fr. the Gr. *στρόβος*, a Persian incense-bearing tree, the term *stobilus* (a cone or anything twisted) either comes from or gives rise to this word.

Styraciflua — L. (styrax-flowing) fr. the Gr. *στύραξ*, the tree, and the L. *fluere*, to flow; referring to the juices of *Liquidambar Styraciflua*.

sulcate — L. (furrowed) fr. *sulcus*, a furrow; referring to the character of the bark or the grooved leaf-petioles of *Carya laciniosa*. (?)

Sumach — fr. the Arabic summacs through the Sp. zumaque, the Fr. sumac, and the M. E. sumac. The common name of *Rhus*.

Sycamore — fr. the Gr. *σίκον*, a fig, and *μόρον*, the mulberry, through the L. *sycamorus*. Perhaps originally fr. the Heb. shiqmah, the plane tree. The common name of *Platanus* owing to the multiple fruit.

sylvatica — L. (belonging to the woods) fr. *silva*, a forest; referring to the habitat of *Nyssa sylvatica*.

Tacamahac — fr. the Aztec tecomahiyac in reference to the resin of *Bursera tomentosa*, through the Sp. tamahaca, the Fr. tamahaque, and the E. tacamahac. Tho common name of *Populus balsamifera* owing to the resinous buds.

Tamarack — Prob. from the Canadian Indian name for *Larix laricina*.

Thomasii — L. for the surname Thomas, given as a synonym for *Ulmus racemosa*.

Thuja — L. L. fr. the Gr. *θυία*, the common name of an aromatic African tree, named from *θύω*, to perfume.

thyoides — L. (Thuja-like) fr. the Gr. *θυία* and *οϊδες*, like; referring to the resemblance of *Chamaecyparis thyoides* to *Thuja*.

Tilia — L. (the linden tree), the L. common name.

tinctoria — L. (dyed) fr. *tingere*, to dye; referring to the orange colored dye in the inner bark of *Quercus velutina*.

tomentosa — L. (woolly) fr. *tomentum*, wool, and *-osus*, full of; referring to pubescent leaves of *Carya alba*.

Toxicodendron — L. (poison-wood) fr. *toxicum* through the Gr. *τοξικος* fr. *τόξον* a bow, in reference to the ancient use of poisoned arrows, and *δένδρον* a tree, given as a generic name for *Rhus vernix*.

Toxylon — L. L. fr. the Gr. *τόξον*, bow, and *ξύλον*, wood; a name suggested by the use of the wood for bows by the Indians.

tremuloides — L. (trembling-like) fr. the Gr. *τρέμω* and *οϊδες*, like; referring to the trembling leaves of *Populus tremuloides*.

triancanthos — L. (3-spines) fr. the Gr. *τρία*, three, and *ἀκανθά*, a spine; referring to the branched spines of *Gleditsia triancanthos*.

trifolia — L. (3-leaved) fr. tres (trial) three, and *folium*, leaf; referring to the three leaflets in the compound leaf of *Ptelea trifolia*.

triloba — L. (3-lobed) fr. *tria*, three, and the Gr. *λόβος*, lobe; referring to the 3-lobed calyx of *Asimina triloba*.

Tsuga — L. L. fr. the Japanese common name of a species of hemlock.

Tulip-tree — fr. the L. *tulipa* (seo tulipifera) and tree (see coffee-tree). The common name of *Liriodendron tulipifera* owing to the showy flowers.

tulipifera — L. L. (tulip-bearing) fr. the Pers. dulbend, a tulip, and the L. *ferre*, to bear; referring to the tulip-like flowers of *Liriodendron tulipifera*.

Tupelo — fr. the N. Am. Indian common name for *Nyssa*.

typhina — L. (cat-tail-like) fr. the Gr. *τύφη*, (L. *Typha*); referring to the hairy twigs of *Rhus typhina*.

Ulmus — L. (elm) fr. the common name of the elm.

variifolium — L. (various-leaved) fr. *varius*, changeable, and *folium*, leaf; referring to the several types of leaves of *Sassafras variifolium*.

velutina — L. (velvety) fr. *vellus*, a fleece; referring to the pubescent cup-scales of *Quercus velutina*.
venenata — L. (poisonous); referring to the toxic properties of *Rhus Vernix*.
Vernix — L. (varnished) a resin; referring to the shiny leaflets of *Rhus Vernix*. (?)
Viburnum — L. for the common name of the species.
virginiana — L. L. for the state of Virginia; referring to the geographical habitat of several species.
virginica — a variant of *virginiana*.
vesca — L. (edible) fr. *vescor*, to eat; referring to the fruit of *Castanea dentata*.
viridis — L. (green); referring to the green under-surfaces of the leaves of *Salix fragilis* and *Fraxinus pennsylvanica*, *var. lanceolata*.
vitellina — L. (yellow) fr. *vitellus*, the yolk of an egg; referring to the yellow branches of *Salix alba*, var. *vitellina*
vulgaris — L. (common) fr. the Skt. varga, a group of men, through the L. *vulgus*, a crowd, referring to the general distribution of *Castanea dentata*.
Walnut — wal — fr. the A. S. wealh, foreign. * the Teutonic, and nut (see butternut). The common name of *Juglans* and *Carya*.
Willow — fr. the A. S. welig through the M. E. willow in reference to the pliant branches. The common name of *Salix*.

GLOSSARY

Abaxilly. On the side away from the axis; on the lower surface.
Abortion. The arrested development or non-development of an organ.
Abortive. Imperfectly developed; non-functioning; non-fertile.
Accessory. Something additional; of the nature of an appendage.
Acicular. Slenderly needle-shaped.
Acidulous. Somewhat sour.
Acorn. The fruit of the oak, consisting of a nut with its base enclosed in a cup of imbricated scales.
Acrid. Bitterly pungent; irritating.
Acuminate. Ending in a tapering point.
Acute. Tapering to a point at an angle less than a right angle.
Adnate. Said of unlike parts which grow together.
Adaxilly. Borne on the side nearest the axis, as the upper side of a leaf.
Albumen. Nutritive material surrounding the embryo in seeds.
Albuminous. Furnished with albumen.
Alternate. Placed singly along a primary axis.
Ament. A scaly spike generally with a lax axis.
Anastomosing. Uniting to form reticulations.
Androgynous. Composed of both staminate and pistillate flowers.
Angiospermous. Having the seeds borne within a pericarp.
Anther. The pollen-bearing portion of the stamen.
Anthesis. The time of expansion of a flower.
Apetalous. Without petals or corolla.
Apex. Top; tip; that portion farthest from the point of attachment.
Apiculate. Ending in a short pointed tip.
Apophysis. An enlargement or swelling on the surface of an organ at some particular part.
Appressed. Lying flat against or together for the whole length.
Arborescent. Tree-like in growth or general appearance.
Arcuate. Moderately curved.
Aril. An extraneous or late-formed seed coat or covering; an appendage growing from the stalk of the ovule prior to ripening.
Aromatic. Fragrant; spicy.
Ascending. Curving or rising obliquely upward.
Attentuate. Slenderly tapering.
Auriculate. Furnished with ear-shaped appendages or auricles.
Awl-shaped. Narrow, terete or somewhat so, and attentuate from a broader base to a slender or rigid point.
Awn. A bristle-shaped appendage.
Awned. Provided with or bearing an awn.
Axil. The upper angle between a lateral organ and the main axis.
Axillary. In, or growing from the axil.
Axis. The central line or longitudinal support on which organs or parts are arranged.

Baccate. Berry-like; pulpy throughout.
Bearded. Bearing a tuft of hairs.
Berry. A fruit which is fleshy throughout except the seed.
Bi-. The Latin prefix meaning twice or doubly.
Bifurcated. Divided into two branches or parts; forked.
Bilabiate. Two-lipped.
Blunt. Without a point.
Bole. Stem or trunk.
Bract. A leaf (more or less modified) subtending a flower, or belonging to an inflorescence or a stem.
Bracteate. Having bracts.
Bracteolate. Having bractlets.
Bracteole. Secondary bract. See Bractlet.
Bractlet. Secondary bract; a little bract.
Bundle-scars. The scars within a leaf-scar; the calloused ends of the fibro-vascular bundles in a leaf-scar.

Caducous. Falling off very early. See Evanescent.
Calyx. The outer perianth of a flower; the outer floral envelop, generally green in color.
Campanulate. Bell-shaped.
Canescent. Hoary, usually with gray pubescence.
Capitate. Arranged in a head; collected into a head.
Capsule. A dry dehiscent fruit composed of more than one carpel.
Carinate. Ridged; keeled.
Carpel. A simple pistil, or a member of a compound pistil answering to one leaf.
Catkin. Same as ament.
Caudate. Furnished with a slender tip or tail-like appendage.
Chlorophyll. The green coloring matter within the cells of plants.
Ciliate. Marginally fringed with hairs.
Cinerous. Ash-colored.
Clavate. Club-shaped.
Clawed. Attached at the base by a narrow prolongation or claw.
Coherence. The growing together of like parts.
Columnar. Having the form of a column.
Comose. Bearing a tuft of silky hairs at the end.
Compound leaf. A leaf consisting of separate leaflets.
Compound ovary. The base of a pistil composed of more than one carpel.
Compressed. Flattened, especially laterally.
Concave. The interior of a curved surface.
Conduplicate. Folded together lengthwise.
Cone. A solid figure with a circular base and the apex tapering to a point.
Confluent. United with or passing by degrees into another.
Conic, Conical. Cone-shaped.
Conifer. A cone-bearing gymnosperm.
Connate. Like parts united during their formation.
Connivent. Coming into contact; converging.
Convex. The exterior of a curved surface.
Cordate. Heart-shaped.

Coriaceous. Leathery.
Corolla. The inner, usually bright-colored portion of the perianth; the inner floral envelop of a flower.
Cortex. Rind; bark.
Corymb. An indeterminate flat-topped flower cluster.
Cotyledons. The foliar portions or first leaves of the embryo as found in the seed.
Crenate. Scalloped; serrate with rounded teeth.
Crenulate. Diminutive of crenate.
Crown. The expanded top of a tree or shrub consisting of branches and branchlets.
Cruciate. Cross-shaped.
Cuneate. Wedge-shaped.
Cuneiform. Wedge-shaped. See Cuneate.
Cuspidate. Tipped with a cusp or sharp and ridgid point.
Cyme. A broad and flattish flower-cluster of the determinate type.
Cymose. Cyme-like, or borne in a cyme.

Deciduous. Subject to fall in season; not evergreen.
Declined. Sloping downwards.
Decompound. More than once compound or divided.
Decurrent (leaf). Extending down the stem below the insertion.
Decussate. Alternating in pairs at right angles.
Dehiscent. Opening at maturity to release the seed.
Deliquescent. Dissolving or melting away. Said of a stem which divides into branches.
Deltoid. Shaped like an equilateral triangle.
Dentate. Toothed, with the teeth directed outward.
Denticulate. Diminutive of dentate.
Depressed. Somewhat flattened from above.
Determinate inflorescence. An inflorescence the primary axis of which is terminated by a flower.
Diadelphous (stamens). Combined in two sets.
Diaphragmed. Divided into chambers by cross partitions.
Diaphragmed-stuffed. Diaphragmed with filled chambers.
Dichotomous. Forking regularly by pairs.
Dicotyledonous. Having two cotyledons.
Didynamous (stamens). Two pairs of unequal length.
Dioecious. Unisexual, with the staminate and pistillate flowers on separate plants.
Disk. A development of the receptacle at or around the base of the pistil.
Divergent. Proceeding in different directions from each other or from a point
Drupaceous. Drupe-like, or of the nature of a drupe.
Drupe. A fleshy fruit with a bony endocarp enclosing the seed.

Ebracteolate. Without bractlets.
Echinulate. Beset with diminutive prickles.
Eglandular. Without glands.
Ellipsoid. A solid obtained by rotating an ellipse on its long axis.
Ellipsoidal. Resembling an ellipsoid.

Elliptic, Elliptical. Shaped like an ellipse.
Emarginate. With the margin notched; notched at the apex.
Embryo. The rudimentary plantlet within the seed.
Endocarp. The inner layer of a pericarp.
Entire. Without divisions, lobes or teeth.
Epaulet. A shoulder ornament formerly worn on military and naval uniforms.
Epidermis. The superficial layer of cells.
Epigynous. Adnate to or borne on the upper part of the ovary.
Erect. Upright.
Erose. As if gnawed; applied to an irregularly-toothed or eroded margin.
Evanescent. Early disappearing.
Exalbuminous. Without albumen.
Exfoliate. To come off in layers or scales.
Exserted. Projecting beyond other organs.
Extrorse. Facing outward.

Falcate. Scythe-shaped; curved like a scythe.
Fascicle. A close bundle or cluster.
Fascicle-sheath. A tubular envelope at the base of a fascicle.
Fasciculate. Borne in fascicles.
Ferruginous. Rust-colored.
Fibrous. Composed of or resembling fibers.
Filament. The portion of the stamen supporting the anther.
Filamentous. Slender; thread-like.
Filiform. Thread-shaped; long, slender, and terete.
Fimbriate. Fringed.
Flaccid. Lax; limp; flabby.
Flexuous. Zizzag; bending alternately in opposite directions.
Fluted. With alternate ridges and depressions.
Foliaceous. Leaf-like in texture or appearance; bearing leaves.
Follicle. A simple fruit dehiscing along one suture.
Fringed. Bordered with slender processes or marginal appendages.
Fruit. The seed-bearing portion of a plant.
Fruticose. Pertaining to or resembling a shrub.
Fugacious. Evanescent.
Funicle. The free stalk of an ovule or seed.
Funicular. Pertaining to the funicle.
Gamopetalous. With united petals.
Gamosepalous. With united sepals.
Geniculate. Bent abruptly like a knee.
Gibbous. Swollen or enlarged on one side.
Glabrous. Free from hairs or down.
Gland. A secreting surface or structure.
Glandular. Bearing glands.
Glaucous. Covered or whitened with a bloom.
Globose, Globular. Somewhat or nearly globose.
Granulose. Composed of or appearing as if covered by minute glands.
Gymnospermous. Bearing naked seeds; without a pericarp.

Habit. General appearance of the plant.
Head. A cluster of sessile or subsessile flowers on a very short axis or receptacle.

Heart-shaped. Ovate with a rounded sinus at the base.
Herb. A plant with no persistent stem above ground.
Hirsute. Pubescent, with rather coarse, stiff hairs.
Hoary. Grayish white, with a fine, close pubescence.
Hybrid. A cross-breed of two species.
Hypogynous. Borne at or below the base of the ovary.

Imbricated. Overlapping like shingles on a roof.
Impressed. Sunken as though by pressure.
Incised. Cut sharply, irregularly, and more or less deeply.
Indehiscent. Remaining persistently closed.
Indeterminate inflorescence. One where the main axis is not terminated by a flower.
Indigenous. Native and original to the region.
Inequilateral. With unequal sides.
Inferior. Relating to an organ which arises or is situated below another.
Inflated. Bladdery.
Inflorescence. Flower-cluster.
Inserted. Attached to or growing out of.
Internode. The portion of a stem between two nodes.
Intolerant. Incapable of recovery after suppression.
Introrse. Turned inward or toward the axis.
Involucre. The whorl of bracts subtending a flower or flower-cluster.
Irregular. Not symmetrical; said of a flower which cannot be divided into equal parts by more than one plane of symmetry.

Keel. The two anterior united petals of a papilionaceous flower.
Keeled. Carinate.

Laciniate. Cut into deep irregular segments or lobes.
Lamina. The blade of a foliage leaf.
Lanceolate. Shaped like a lance-head; several times longer than wide, broadest above the base, and narrowed to the apex.
Lax. Loose.
Leaf. A green expansion attached to a stem in which the manufacture of organic food takes place
Leaflet. A single division of a compound leaf.
Legume. A simple fruit dehiscing along two opposite sutures.
Lenticel. Lenticular excrescences on young bark, providing aeration.
Lenticellate. Bearing lenticels.
Ligulate. Strap-shaped.
Limb. The expanded portion of a gamopetalous corolla above the throat; the expanded portion of any petal, or of a leaf.
Linear. Much elongated with the sides nearly parallel.
Lobe. A division of an organ, generally rounded.
Locule. A cell of the ovary.
Loculicidal. Dehiscent into a locule through the dorsal suture.
Lunate. Crescent-shaped.
Lustrous. Glossy; shining; possessed of a sheen.
Lyrate. Pinnatifid with a large and rounded terminal lobe, the lower lobes progressively smaller.

Mammillate. See Papillate.
Mealy. Covered with meal-like powder.
Membranaceous, Membranous. Thin and rather soft or pliable often translucent.
Midrib. The central or main rib of a leaf.
Monoecious. Unisexual, with the staminate and pistillate flowers on the same plant.
Monopodial. With a main or primary axis which gives off secondary axes in acropetal succession. Said of a tree-bole which continues through the crown.
Mucilaginous. Slimy; of the consistency or appearance of mucilage.
Mucro. A short and small abrupt tip.
Mucronate. Tipped with a muero.

Nectariferous. Producing nectar.
Node. That portion of a stem which normally bears one or more leaves.
Nomenclature. The system of names used in any science or art.
Nut. A bony or woody indehiscent fruit resulting from either a simple or compound ovary.
Nutlet. Diminutive of nut.

Ob-. Latin prefix usually conveying the idea of inversion.
Oblique. Slanting; declining from the vertical or horizontal.
Oblong. Longer than broad with the sides approximately parallel.
Obtuse. Blunt or rounded.
Odd-pinnate. Pinnate with an odd number of divisions.
Ochraceous. Light yellow with a tinge of brown.
Opposite. Set against; said of leaves when inserted two at a node.
Orbicular. Circular; spherical.
Oval. Broadly elliptical; egg-shaped.
Ovary. The ovule-bearing portion of the pistil.
Ovate. Of the shape of a longitudinal section of an egg, the broad part basal; also used to designate an egg-shaped solid.
Ovoid. Solid ovate; solid oval.
Ovulate. Bearing ovules.
Ovuliferous. Bearing ovules.
Ovule. An immature seed.

Palmate. With several divisions or lobes which radiate from a point.
Panicle. An irregularly-branched racemose cluster.
Paniculate. Panicle-like, or borne in panicles.
Papilionaceous. The peculiar type of corolla found in the sweet pea and other Leguminosae.
Papillate, Papillose. Bearing minute nipple-shaped projections.
Parietal. Borne on or pertaining to the wall or inner surface of a capsule.
Parted. Cleft nearly but not quite to the base.
Pedicel. The stalk of a single flower.
Pedicellate. Borne on a pedicel.
Peduncle. The primary flower-stalk supporting either a single flower or an inflorescence.
Pedunculate. With a peduncle.
Pellucid. Clear; transparent.

Peltate. Shield-shaped; a flat body attached to a support by its lower surface.
Pendulous. Loosely pendant; more or less hanging.
Perfect (flower). Having both pistil and stamens.
Perianth. The floral envelop; usually used when calyx and corolla are not easily distinguishable.
Pericarp. The wall of the fruit or seed-vessel.
Perigynous. Adnate to the perianth, and therefore around the ovary and not at its base.
Petal. One of the modified leaves forming the corolla.
Petaloid. Colored and resembling a petal.
Petiole. The stalk of a leaf.
Petiolulate. Having a petiolule.
Petiolule. The stalk of a leaflet.
Phyllotaxy. The arrangement of leaves upon the stem.
Pilose. Hairy with soft hairs.
Pinna. A single leaflet in a compound leaf.
Pinnate. Compound, with leaflets arranged along opposite sides of a common petiole.
Pinnatifid. Pinnately cleft.
Pinniveined. Pinnately veined; with prominent midrib and secondary veins.
Pistil. The seed-bearing organ of a flower, consisting of ovary, stigma, and connecting style when present.
Pistillate. Provided with pistils and usually in the sense of without stamens.
Placenta. Any part of the interior of the ovary which bears ovules.
Plumose. Having fine hairs on each side, like the plume of a feather.
Pod. Any dry and dehiscent fruit.
Pollen. The fecundating grains contained in the anther.
Polygamo-monoecious. Bearing perfect and unisexual flowers of both sorts on the same plant.
Polygamous. Bearing perfect and unisexual flowers on the same plant.
Polypetalous. Having separate petals.
Pome. A fleshy fruit, like the apple, with a papery or cartilaginous interior enclosing the seed.
Posterior. Behind; on the side toward the axis.
Prickle. A small spine formed as an outgrowth of the bark or rind.
Proterandrous. Said of flowers in which the anthers shed their pollen before the stigma is receptive.
Proterogynous. Said of flowers in which the stigma is receptive to pollen before the anthers shed their pollen.
Proximal. That part nearest the point of attachment.
Puberulent, Puberulous. Minutely pubescent.
Pubescent. Covered with hairs, especially if short, soft, and down-like.
Punctate. Dotted with small depressions, translucent internal glands, or colored dots.
Pyriform. Pear-shaped.
Pyramidal. Shaped like a pyramid.

Quadrangular. A four-angled figure; often signifying rectangular.

Raceme. A simple indeterminate flower-cluster with pedicelled flowers on a lengthened axis.

Racemose. Raceme-like, or borne in racemes.
Rachis. The axis of a compound leaf; the axis of a spike or raceme.
Receptacle. The terminal portion of an axis forming a common support on which floral organs or flowers are borne.
Reflexed. Turned or bent abruptly backward.
Reniform. Kidney-shaped.
Repand. With a slightly wavy or sinuate margin.
Resin. An amorphous substance that exudes from plants and supposed to be the product of oxidation of volatile oils.
Resin cyst. A sack or cavity filled with resin.
Resinous. Resin-bearing; having the qualities of resin.
Reticulate. Netted; in the form of a network.
Retuse. With a shallow notch at a rounded apex.
Revolute. Rolled backward from the margin or apex.
Rhombic. With the shape of a quadrangular figure with equal sides but not right angles.
Roseate. Rosy; tinged with rose color.
Rudimentary. Undeveloped.
Rufous. Reddish brown.
Rugose. Wrinkled.
Rusty. Having the color of iron rust.

Saccate. Sac-shaped.
Samara. An indehiscent winged fruit.
Samaroid. Diminutive of samara.
Scabrous. Rough to the touch.
Scale. A thin scarious body, usually a degenerate leaf, sometimes of epidermal origin.
Scaly. Bearing scales.
Scarious. Thin, dry, membranous, often translucent.
Scurfy. Covered with small bran-like scales.
Seed. The ripened ovule consisting of the embryo and its proper coats.
Seminal cavity. The cavity in which the seed or seeds are borne.
Sepal. One of the modified leaves forming the calyx.
Septate. Divided by partitions.
Septicidal. Dehiscing through the partitions and between the locules.
Serrate. Toothed, with the teeth directed forward.
Serrulate. Diminutive of serrate.
Sessile. Without a stalk.
Shrub. A woody plant, generally under twenty feet in height, usually with several stems.
Silky. Covered with close-pressed, soft and straight pubescence.
Sinuate. With a strongly wavy margin.
Sinus. The opening between two lobes of a leaf.
Spatulate. Gradually narrowed downward from a rounded summit.
Spicate. Arranged in or resembling a spike.
Spike. A simple indeterminate flower-cluster with sessile flowers.
Spine. A sharp, woody or rigid outgrowth from the stem.
Spinescent. Ending in a spine.
Spinose, Spiny. Bearing spines.

Spinulose. Bearing small spines.
Spur-shoot. Short stubby branch bearing leaves or fruit.
Stamen. One of the pollen-bearing organs of the flower.
Staminate. Provided with stamens and usually in the sense of without pistils
Staminode. A sterile stamen or other organ in the position of a stamen.
Standard. The upper dilated petal of a papilionaceous corolla.
Stellate. Star-shaped.
Sterigma. Projection from a twig bearing leaves in some conifers.
Stigma. That portion of the pistil which is receptive to pollen.
Stigmatic. Belonging to or characteristic of the stigma.
Stipular. Pertaining to stipules.
Stipule. An appendage at the base of a petiole or on each side of its insertion
Stoma (pl. stomata). An office in the epidermis of a leaf.
Stomatiferous. Bearing stomata or "breathing pores."
Strap-shaped. Long, flat, and comparatively narrow.
Strobile. An inflorescence with imbricated bracts or scales.
Style. That portion of the pistil which, when present, connects the ovary and stigma.
Sub-. The Latin prefix signifying "somewhat" or "slightly."
Subtend. To be inserted under; to embrace in an axil.
Subulate. Awl-shaped.
Succulent. Juicy; fleshy.
Sulcate. Longitudinally grooved or furrowed.
Superior. Said of an organ when inserted above or when free from another.
Suture. Line of dehiscence or opening.
Syncarp. A fleshy multiple or aggregate fruit.

Taper. Gradually narrowing toward one end.
Taxonomy. Classification, especially of plants and animals, according to natural relationships.
Terete. Circular in cross section.
Ternate. In threes.
Testa. The outer coat of a seed, commonly hard and brittle.
Thyrse. A mixed flower-cluster with the main axis indeterminate and the secondary or ultimate determinate.
Tolerant. Capable of recovery after suppression.
Tomentose. Bearing tomentum.
Tomentum. A pubescence composed of matted woolly hairs.
Torus. The receptacle of a flower.
Trigonous. Three-angled.
Truncate. Ending abruptly as if cut off at the tip.
Tuberculate. Beset with knob-like projections.
Tubular. Tube-shaped.
Turbinate. Top-shaped; inversely conical.

Umbel. A simple indeterminate inflorescence in which the pedicels spring from a common point.
Umbellate. Umbel-like, or borne in umbels.
Umbo. Knob; protuberance.
Undulate. With a wavy margin or surface.

Unguiculate. Contracted at the base into a claw.
Urceolate. Urn-shaped; pitcher-shaped.
Urn-shaped. Hollow and contracted at or below the mouth.

Valvate. Opening as if by doors or valves (as a capsule); the parts of a flower-bud when they exactly meet without overlapping.
Veins. Threads of fibro-vascular tissue in a leaf or other organ.
Ventral (leaves). Pertaining to the lower or abaxial side. (Floral organs) That surface which faces the center of the flower.
Ventricose. Swelling unequally or inflated on one side.
Verticillate. Whorled; with three or more leaves or branches at a node.
Vestigial. Pertaining to a vestige or remnant.
Villous. With long, soft, unmatted hairs.
Viscid. Glutinous; sticky.

Whorled. Verticillate; with three or more leaves or branches at a node.
Woolly. Clothed with long and tortuous or matted hairs.

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